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FACTORY

MANAGEMENT AND MAINTENANCE

A McGRAW-HILL PUBLICATION

SEPTEMBER 1942

SOMERVELL on Services of Supply — page 74

The Crisis in Worker Transportation — page 78

No need to waste words telling you the *importance* of scrap; you know that. But have you really combed the premises for it—the way you'd ransack the house for a missing collar button, fifteen minutes before a banquet?

The scrap-yard isn't the place to start the hunt. It's in the cellar, on the roof, in dark corners and dead-storage space, that you'll strike pay-ore.

It may be old equipment—"too good to throw away" at the time it was replaced . . . it may be material the scrap dealer once turned down, because of cost of cutting up and transporting, during a weak scrap-market period . . . it may be an obsolete structure, machine or piece of equipment left in place when its usefulness ended, and now so much a part of the scenery that you aren't conscious of its existence.

For instance—one engineer recently looked out of his hotel window and saw on a set-back roof an I-beam, useless for years, but a "national resource" today. Another noticed an old weed-covered lock-gate along a canal. Not worth salvaging when discarded, but a bonanza in 1942. These two finds alone represented tons of valuable material.

LOOK HERE for SCRAP

Discarded equipment in dead storage . . . Obsolete structures of equipment not razed . . . Abandoned or forgotten pipelines and fittings . . . Discarded parts of equipment or product . . . Doubtful dies, tools, fixtures . . . "Frozen" products in process.

Right now the scrap lying idle throughout the country is more important to the nation than all its gold . . . because without scrap the fine steels so vital to victory cannot be produced in needed tonnages. Rounding it up is a job that depends on individual efforts. Will you help?

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Producers of Standard Alloys—High Heat Resisting Steels—Wrought Iron

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On the cover, electric panel assembly time has been cut 73 percent by setting up the workplace according to work simplification principles. Operator uses two-handed assembly method. Pre-positioned nut runner changes tedious hand operation to rapid routine. Kodachrome from Vultee Aircraft, Inc., Inland Division. Photograph was taken just before the red bull's-eye was dropped from the official Air Corps insignia.

A. M. STAEHLE, Publisher • L. C. MORROW, Editor • G. A. VAN BRUNT, LEWIS K. URQUHART, CHARLES B. COATES, Associate Editors • S. M. COE, Assistant Editor • A. H. MOGENSEN, ARTHUR VAN VLISSINGEN, WHITING WILLIAMS, Consulting Editors • H. P. DUTTON, Chicago • C. B. GORDY, Detroit • PAUL WOOTON, Washington • H. E. HILTY, Sales Manager.

Factory Management and Maintenance is a consolidation of Factory and Industrial Management (including "Factory") and Maintenance Engineering. Price 35c a copy. Allow at least ten days for change of address. All communications about Subscriptions should be addressed to the Director of Circulation, Factory Management and Maintenance, 330 West 42nd Street, New York, N. Y.
Subscription rates — United States, U. S. Possessions and Latin American Republics, $3 for 1 year, $4 for two years, $5 for three years. Canada, $3.50 for one year, $5 for two years, $6 for three years. All other countries, $4 or 24 shillings for one year, $6 or 36 shillings for two years, $8 or 48 shillings for three years. Cable address, "McGrawhill, New York." Member A.B.P. Member A.B.C. Copyright 1942 by McGraw-Hill Publishing Co., Inc.

Factory Management and Maintenance, September, 1942. Vol. 100; No. 9. Published monthly, McGraw-Hill Publishing Co., Inc. Publication office, 99-129 North Broadway, Albany, N. Y. Editorial, executive, and circulation offices, 330 West 42nd Street, New York, N. Y. Entered as second class matter, November 13, 1936, at Post Office Albany, N. Y., U. S. A., under the act of March 3, 1879. Branch offices: 520 North Michigan Ave., Chicago; 68 Post St., San Francisco; Aldwych House, Aldwych, London, W.C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Atlanta, Ga.; Los Angeles, Calif.

McGRAW-HILL PUBLISHING CO., INC.
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SEPTEMBER · 1942

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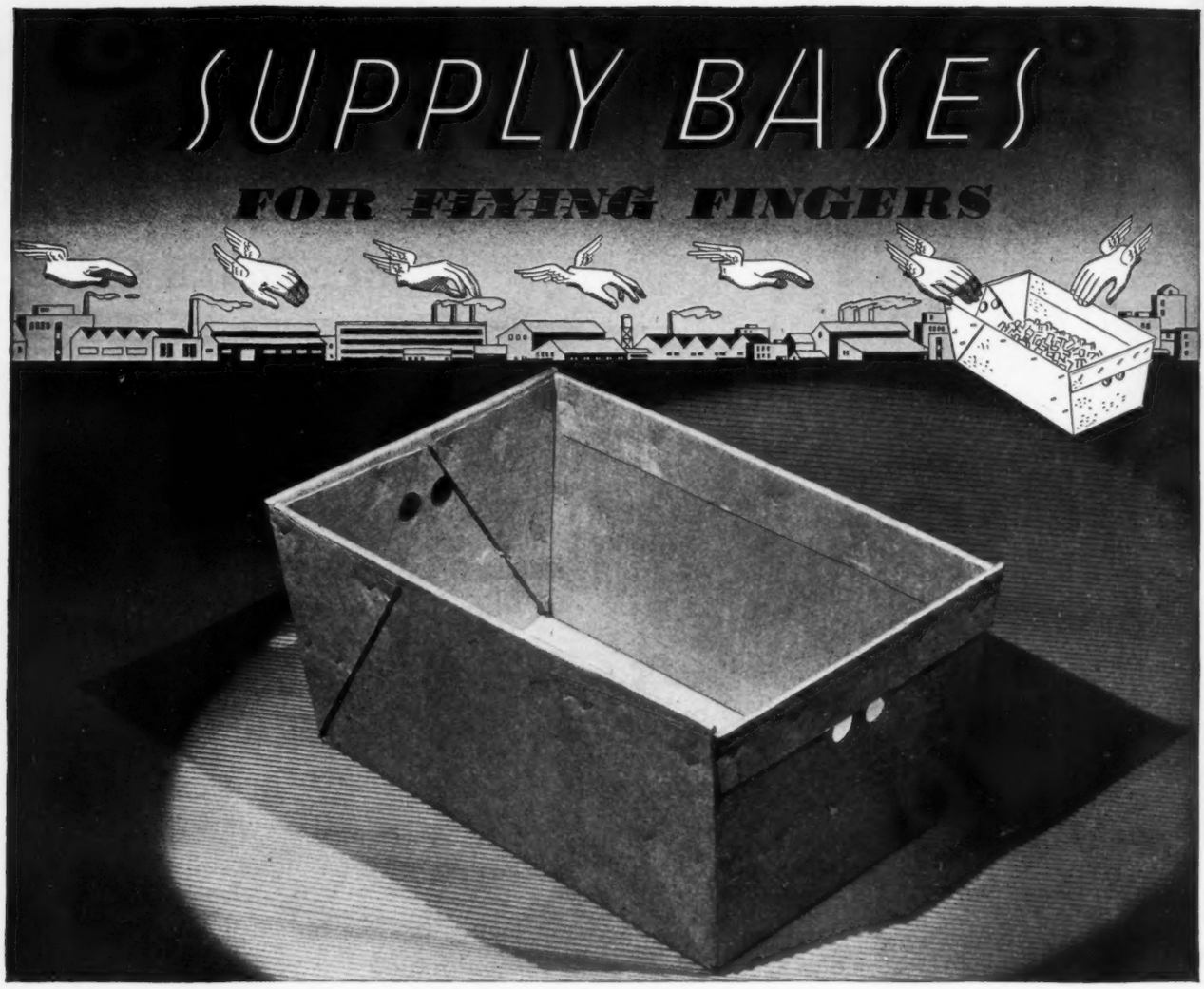

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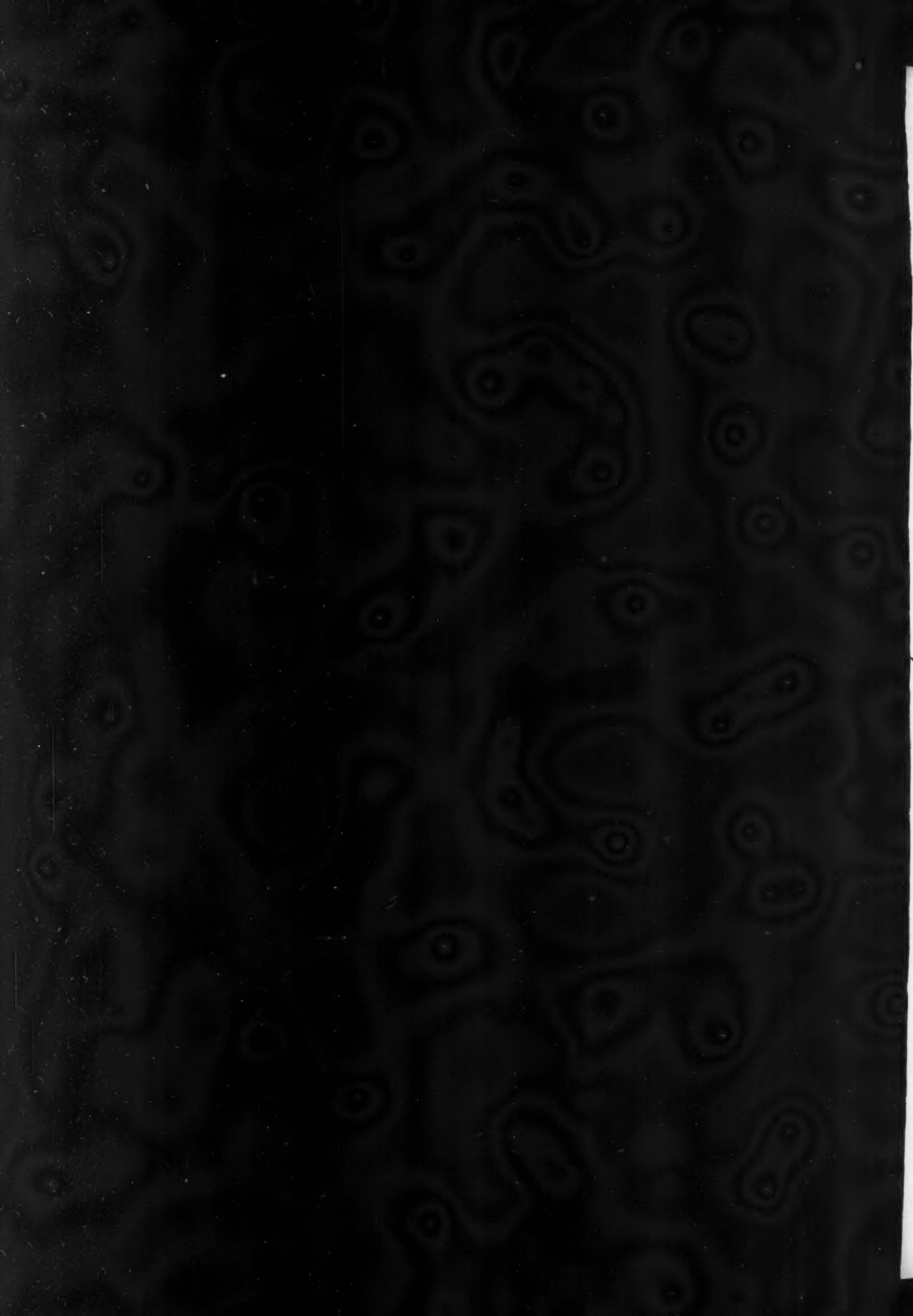


The Aviation Industry is doing its job...

A Year's Production A Week — Every Week

A MERE hundred planes a month in 1938; 200 in 1939; 450 in 1940; 1,600 in 1941, and today, as this is written, plane production goes on at a rate of 5,000 a month. A previous year's production now in one single week — every week.

So begins the story of the greatest industrial expansion in history; an industrial miracle that far surpasses anything our enemies ever have done or can do. Not only did we out-produce the Axis but the acceleration in our production during the past 12 months exceeded the greatest increase in German output during their forced-draft war preparation of 1939, when their production rose from 1,100 to 1,600 planes per month.

The toughest part of our job was accomplished in 20 months. We boosted deliveries from 100 or so to 1,000 planes a week, passing the combined Axis powers. Today, Germany's curve is flattening; ours is climbing steeply. Lt. Gen. Henry H. Arnold, Chief of the Army Air Forces, assures us that Army contractors will produce not less than 148,000 planes in the remainder of 1942 and in 1943. During that same period Navy contractors will turn out at least 37,000 additional planes.

Manpower in the airframe, engine and propeller industries was increased from 125,000 to 450,000 workers during the past 20 months, with the prospect that the industry will be employing more than 1,000,000 men and women in 1943. Many manufacturers are solving their personnel problems by recruiting women workers. More than 40,000 of them — teachers, stenographers, waitresses, housewives and school girls — today are welders, assemblers, machine operators and inspectors on aircraft production lines. Productive floor space in the airframe, engine and propeller industries expanded from 18,000,000 sq. ft. to nearly 55,000,000 sq. ft. during the last 20 months. Further expansion to more than 60,000,000 sq. ft. may be expected this year and an ultimate figure of more than 100,000,000 is a distinct possibility.

To grasp the full magnitude of this task we must remember that a single medium bomber has 30,000 parts, which are built into 650 minor sub-assemblies to make 32 major sub-assemblies. The entire process involves 30,000 man hours of labor. Each of the two engines in this plane requires 50,000 specialized inspections. Every one of the 50 instruments entails many hours of precision workmanship. Yet today there is one factory turning out 4 bombers every day. Another produces fighters at the rate of nearly 20 a day.

To the amazement of the entire world these manufacturing miracles were accomplished without sacrificing the high standard of American aeronautical equipment. There has been some loose talk about the quality of our combat airplanes as compared with those of our allies and our enemies. Indisputable evidence of the superior stamina of our aircraft under fire is written between the lines of almost every war communique. Every battle record tells a story of heavy losses inflicted at small cost upon numerically superior enemy forces. The consistency of this performance on all the far-flung battlefronts constitutes the most eloquent testimony of the high calibre of our designs, our manufacturing methods and the skill and daring of our pilots.

And let us remember that our decisive victory in the battle of production was not won without headaches and heartaches on the part of management, labor and government.

When the President sounded the call for 50,000 planes in the spring of 1940, the program called for only 5,500 military aircraft. Government and industry reeled from the shock — both determined, however, that it ***could and would be done.***

The Army, the Navy and the old Defense Advisory Commission set to work to draft a program. This has been revised many times — upward! Congress then proceeded, more slowly, to modify the laws that would have obstructed the realization of the objective. Then the aviation industry, without contracts, in the face of discriminatory profit-limitative legislation, and with nothing but oral assurances of governmental intentions, went ahead with its Herculean expansion plans. New factories were completed long before facilities-contracts and their funds were forthcoming.

The rugged individualists who had founded and built the aviation industry cast aside their rivalries and embarked upon a period of unselfish cooperation. Priceless engineering experience was exchanged. Material was relinquished for transfer to plants where it was needed more urgently. Successful personnel training methods and experience in the use of women workers were pooled for the benefit of all concerned. During one re-

cent month, the cooperation among eight southern California plants averted more than 1,860 potential bottlenecks in production.

As the lessons of the war dictated the need for greater numbers of particular airplane types, many manufacturers accepted orders for planes designed and developed at rival factories. Striking examples are the long range bombers being turned out by plants where only trainers, fighters or dive bombers formerly were made.

Mindful of the risk involved in educating rivals, thereby creating future potential competition, subcontractors nevertheless were sought and trained by pioneer manufacturers. Makers of toys and wheelbarrows, automatic stokers and linoleum were among those who rallied to the call. Within a year subcontracting rose from 13 to 36 per cent of the total program. It still is rising.

When the automotive industry came into the picture, aviation manufacturers gave generously of their time and knowledge to start the newcomers. Liberal licensing arrangements enabled them to reap the full benefits of technical developments. Automotive engineers swarmed through the aviation plants in search of the exacting "know-how" of the aeronautical industry.

Each type of aircraft that reaches the production stage is the result of long periods of research, design and development. The unseen workers toiling in the wind tunnels and the laboratories of government and industry are the unsung heroes who tirelessly are striving to surpass all previous efforts. Their brilliant accomplishments are eloquent testimony of the superiority of men and women who are blessed with freedom of action and thought. Today more than 20 experimental combat airplanes are under development and will replace older types as soon as they fulfill the exacting requirements of our armed forces. Among these are aircraft that promise to outfight and to out-perform any and all of the much vaunted warplanes of the Axis military machine. And this without loss of production.

Every man, woman and child of all the United Nations may fervently be thankful that those who chart our course in aircraft production have not frozen design to such a degree as to make impossible the immediate adoption of improvements as they come out of these laboratories.

What does this brilliant record mean in terms of final victory?

Every newspaper reader has learned this basic war lesson . . . air supremacy is the essential ingredient of military success. As the balance of air power shifts, so do the fortunes of war.

In those dark days when our output was 500 planes a month, Germany's was 2,000 and the German air force was twice that of our Allies. When we reached 2,000 a month last fall, Germany had advanced to a monthly rate of 2,500. Today, as this is written, we have caught up with the enemy's backlog. The air forces of both sides are about equal numerically and United Nations' production exceeds that of the Axis by 27 per cent. Next summer (1943) both the air force and the output of the United Nations will be double those of all the Axis powers.

That is the pattern of ultimate victory!

The pattern of the peace to follow also is gaining in definition. The airplane has shriveled the world to one-fifth its former size. Its use as an instrument of destruction is but a momentary distortion of the pattern of human progress. Its potential power, as a stern preserver of peace, is beyond imagination. Today's air routes of our Army Air Force Ferrying Command are the international trade routes of tomorrow. Giant airliners, by reducing time and space, will speed fraternity among the nations and disunity will give way to better understanding and goodwill.

Flying freight trains, with aerial locomotives towing glider boxcars, will serve large cities, decentralizing population and giving to inland cities many of the commercial advantages of seaports. Air mail and passenger pick-up lines will fill the gaps between these transcontinental trunk lines and tie in the smallest hamlets. Universal fly-it-yourself services will provide airplane facilities for those who do not own low cost private aircraft. Roadable rotary wing aircraft and family planes of the fixed wing type may even run household errands.

The coming generation of business men who today is piloting our war planes will find aircraft as essential to business as it now finds them essential to victory.

Commenting on our war production record, Donald Nelson has said, "We are today in the position of men who realize that they are actually doing the impossible".

The mass production miracle that the aviation industry – management and workers alike – has performed through the all-out effort of free enterprise can and will serve civilization in peace as it has in war.

With this boundless new medium of transportation and its concurrent technological developments we shall rebuild our way of life to a rich, new fullness upon the ruins of a war-torn world.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.

This is the third of a series of editorials appearing monthly in all McGraw-Hill publications reaching more than one and one-half million readers.

FACTORY
MANAGEMENT AND MAINTENANCE

L · C · MORROW · EDITOR

Materials—and Morale

Industry's principal problem, as we move well into the third year of production for war, is to get enough materials to keep the many items of armament flowing from the factories without interruption. Actual shortages, but also maldistribution, are preventing full use of our greatly increased capacity. This is an employee morale problem as well as a materials problem.

One of the causes of shortage is the failure of balanced schedules on the part of Washington bureaus and departments that have the responsibilities for procurement and allocations. That is something about which the individual manufacturer can do little, if anything.

Another cause, if persistent reports are true, is the existence of unnecessarily large inventories in a great many plants—inventories that will not be used up for many months. A medley of reasons is given for the existence of these stockpiles, most of them netting down to the usual desire to be covered on orders in hand or expected.

Such stockpiles should be redistributed. In the main, expansion and conversion have been accomplished. There will not be sudden enormous drafts of materials. On the contrary, we may expect a relatively even flow from mine to finished product.

A regional director of WPB said recently, "It is just as much our (industry's) job to get rid of surplus inventory as it is to live up to the contracts we have received." Morally, that may be true. But, to be quite practical, redistribution, as well as original allocation, must be done by the government. The factories themselves are too close to the stockpiles.

When, as, and if the government tackles redistribution, industry should gladly cooperate. Both as a group and as individual units, our manufacturing plants cannot afford to have shutdowns and rumors of shutdowns.

How is increased migration of workers to be prevented if idle time becomes a factor in job selection? Of what avail our "production drives" if workers are given cause to feel that by extra effort they are only bringing about layoffs?

For successful operation, workers must have confidence in the production planners—both the men who plan the details in their specific plants, and the men who plan the over-all war production. Which is why I say that the materials problem is also a morale problem, and suggest the importance of definite cooperative action on the part of government and industry.

L C Morrow

What SOS Expects

LIEUT. GEN. BREHON B. SOMERVELL

Commanding, Services of Supply

Services of Supply welds together the nation's two great armies—on the battle front and on the production front. Vital to victory is the coordination of their attack. Here is an important message to management from the man who heads the world's greatest prime contracting organization

"We still wear out rubber unnecessarily. This must stop," warns General Somervell. "American industry has proved again and again that it has the skill, the know-how, to win over tremendous obstacles. It must put the skill to work now, quickly, without one minute's delay. It must find means of substituting all the way down the line." Above, scrap piles at reclaim division of the B. F. Goodrich Company

# of Industry

Press Association, Inc.

Lieut. Gen. Brehon B. Somervell directs the most gigantic military supply operation in the history of the United States if not the world. This Arkansas-born West Pointer's natural capacity for engineering and administration marked him early for a succession of increasingly bigger jobs. Holder of a World War Distinguished Service Cross, he later headed Army engineering districts, directed WPA in New York for four years. As war neared, he took over Army's huge camp construction program, became logical man for his present high post

THE SERVICES OF SUPPLY is a huge factory, the largest factory in the history of the world. It has its shop divisions, its stockrooms and its transmission lines, its designing and testing departments, its front office, its loading platforms, its engineering staff. Its products are materials, munitions, and men. These it delivers to its customers, the United Nations armies in the field.

Like every other factory it has its problems of design, raw material, storage, costs, shortages, transportation, housing, plant protection, schedules and quotas, labor relations, materials handling, and personnel.

A Prime Contractor

It might be compared to a prime contractor. American industry in all its branches serves as subcontractors and suppliers. We all know that no manufacturer can keep his product up to specifications or his production schedules up to date if there's a breakdown either in his own plant or in the plants of his suppliers. He can't deliver to his customers if there's a tie-up in transportation activities or if there are shortages of labor or raw material or of parts.

But this immense factory of ours faces a problem that fortunately never has plagued a private concern. The industrialist who fails for any reason may be sure that somewhere some other industrialist stands ready to take up his unfinished job and carry it to a successful conclusion. At worst, he loses his contract or his plant or his profits, and his employees lose their wages.

But in this task we face today no one is standing in the background ready to take over if we fail. It's up to us. And if we *do* fail, civilization will perish. We must make good not only for our own generation but also for the sake of our children and our children's children.

The task we have set ourselves is so gigantic that men without imagination and without faith have called our problems insurmountable. It is true that we have not surmounted all of them. But that does not mean we cannot or will not. It means merely that we have not yet tried hard enough. But we will strive endlessly until we have beaten every obstacle.

These obstacles are many and diverse. They are divided roughly into three classes. First are obstacles that concern the military situation. These are army problems. We shall solve them only after we have solved other problems, just as grave, on the production front.

Second is the problem of manpower

Ewing Galloway

"Greater burdens will be placed on the rails from month to month. The time will come when troop traffic and material traffic will force civilian trains to the sidings and hold them there. When this time comes, American industry will face a new problem, and I am sure will meet it squarely"

and raw materials. Third, there is transportation. These are not separate and distinct; they interlock.

Every factory superintendent knows that skilled manpower is at a premium. However, we have broken down many old ideas, thrown out of the window many outworn conceptions. We have found that training in single skills eases the tension of the manpower shortage.

Industrialists tell me that unskilled workers, trained for nine weeks in a single operation, not infrequently take the places of old-time mechanics. Thus the men of higher skills can be used as foremen and supervisors, and raw recruits in industry can take their places in the shops.

Manpower Is Limited

But our supply of manpower is not inexhaustible. The armed forces will call for more and still more men, young, middle aged, some past middle age. Their places must be filled. And we shall have to depend on women to do more and more work in our factories and shops.

Factories that have experimented over a length of time find that in many operations, particularly those requiring close and detailed attention, women produce as fast as men. They learn even faster in many cases.

Often these women have sons or husbands or brothers or fathers in the armed forces. Wages are not their primary consideration. They are working because they want to do their bit. I know the wife of a major who is working on an assembly line, wives of several junior officers in shops across the country.

Shortages of materials are particularly severe in steel and ferrous alloys.

There are three ways to solve these problems. First, produce more. Second, cut civilian use to absolute minimum. The third way is substitution. Usually substitution requires new designs. It requires an open mind, a willingness to take a chance.

In the two years, 1942-3, we shall save 400,000,000 pounds of copper, probably our most precious metal today, by using steel in cartridge cases instead of brass. Nearly fifty producers now are making steel shell cases. In addition, by substitution and other engineering changes, we shall save 75,000,000 more pounds of copper. That is successful substitution.

By changing our specifications, by working hand in hand with industry, the Army hopes in these two years to save 260,000,000 pounds of aluminum, 63,000,000 pounds of nickel, 20,000,000 pounds of tungsten, 30,000,000 pounds of tin, 15,000,000 pounds of chromium, 270,000,000 of zinc.

Aluminum Saved

These savings are being accomplished by removing aluminum from all non-aircraft production, by eliminating copper and zinc from every item where steel or other metals can be substituted, by reducing the amount of zinc used in galvanizing. Chrome content in many alloy steels has been reduced one-third. So through the list we have substituted metals less precious for those we must do without. In all, we'll save nearly two *billion* pounds of critical materials. But shortages will still persist.

The Army, the Navy, and American industry must share the blame for many of these shortages. Perhaps we were not realistic enough.

But now that the shortages are here, choking off victory, smothering our every attempt to win, it is not yet too late to solve our problems. America still wastes steel. We still wear out rubber unnecessarily. This must stop. American industry has proved again and again that it has the skill, the know-how, to win over tremendous obstacles. It must put the skill to work now, quickly, without one minute's delay. It must find means of substituting all the way down the line.

Industry must forget self absolutely, must forget that it ever knew peacetime rivalries. It must remember that a single hoarded sheet of steel, a single unused bin of bolts, may mean the death of Americans on distant battle fronts. It must not forget that we are losing the war, that we shall continue to lose until we unite unselfishly, until each of us here on the home front is guided in his every thought and action by the same spirit that inspires our soldiers dying on the battle front.

Industry can lead, as it always has led. It can be a guide and an inspiration to all our people. On the whole it is doing this now. But there still remain a few small segments not realistic enough to understand that their own personal gains can destroy civilization for evermore.

Transportation

The last in our series of bottlenecks is transportation. Steel for ships, for cars, for locomotives just doesn't exist in amounts sufficient to build enough. So we must conserve what we have, not turn over a single wheel uselessly. Our railroads are doing a splendid job. They have not failed us even once.

No matter what the task we set, they always come through. There have been nights when tens of thousands of soldiers were being shifted long distances across the continent. On these same nights freight trains laden with raw materials were rushing toward industrial plants, other trains laden with finished products were hurrying to the ports. On top of these peak loads it has been necessary, occasionally, to move a whole division without notice, at express speeds.

A division requires nearly 2000 cars. The railroads didn't bicker. They didn't ask for delay. They moved the troops, and at the same time kept the normal traffic and the abnormal traffic flowing.

But greater burdens will be placed on the rails from month to month. The time will come when troop traffic and material traffic will force civilian trains to the sidings and hold them there. When this time comes American industry will face a new problem, and I am sure will meet it squarely and without complaint.

This factory that we call Services of Supply must keep producing, must continue to turn out what the customer needs so desperately. And American industry, acting as suppliers and subcontractors, will continue to give us the aid we need and will continue to need in ever-increasing quantities. We are counting confidently on the factories of America.

"A huge factory," is General Somervell's quick definition of the Services of Supply. "Its products are materials, munitions, and men. These it delivers to its customers, the United Nations' armies in the field." Below, the Services of Supply makes a delivery to its customers via Atlantic convoy

Press Association, Inc.

Crisis in Worker
—AND WHAT

AMERICA MUST FACE THESE FACTS

1. **On hand: 7 million new tires for 27 million cars. Japs have grabbed 90 percent of crude rubber sources. U. S. stockpile reserved *for military use only***
2. **Current output of synthetic rubber for civilian tires is: NONE**
3. **Twenty million cars are essential to U. S. basic economy. Used at normal rates, today's 27 million cars would dwindle to 4 million by July, 1944**
4. **America's two largest, and fastest growing, groups of drivers—farmers and industrial workers—own the oldest cars with the smoothest tires and depend on them the most. Surveys show that 40 percent of workers' tires will wear out in 6 months, 80 percent within the year**
5. **Public vehicles cannot carry half the load that the automobile carries today. Yet new construction of such vehicles has been sharply curtailed**
6. **ODT Chief Eastman calls auto parts problem almost as serious as rubber**
7. **With all the rubber we needed, we should still face a transportation crisis**

AMERICAN AUTOMOBILES are going off the road at the rate of three a minute. That is the considered estimate of the American Automobile Association.

Can anyone "breathe easy" about this?

No, for the automobile is integrally as much a part of the U. S. war machine as any tank, plane, ship, or gun.

The full significance of this crisis would be more obvious had it not been for the prolonged public squabble about "the rubber situation." It should still be obvious to anyone who considers carefully points 1 to 7 as stated above.

The things industry must do about this are the obvious, officially indicated things:

1. Establish effective group riding plans at once

2. Participate whole-heartedly in community plans for staggering of hours to relieve peak loads on mass transportation

3. Start planning now for the inevitable time when no combination of the above two expedients will suffice to get all the workers to work.

Two of the most responsible federal officials concerned—Joseph B. Eastman and Arthur D. Newhall—have contributed special articles for these pages, stating very specifically the things they want management to understand about the worker transport problem.

See how squarely they put the job up to management. And don't forget that government can *compel* industry to do what these officials are simply *asking* industry to do.

Will history paraphrase fable, some day, by saying, "For want of a tire, the car was lost; for want of a car, the worker was lost; for want of a worker, the war was lost?"

If that happens the historian will be a gleeful Japanazi, dipping deep in the ink which has inscribed the downfall of more than one big, rich, foolish nation.

IN THIS ARTICLE

We Can Lose the War If—*Newhall*

Management's Responsibility—*Eastman*

How Lockheed-Vega Meets the Challenge

Swap-Ride Formula as Used by Kalamazoo

Providence Proves That Staggering Pays

New Links in the Transportation Chain

What of Group-Driver Liability?

Transportation MUST BE DONE ABOUT IT

Wide World

About 75 percent of industrial workers depend on c ars. Public transit simply can't take over such a burden

We Can Lose the War, If—NEWHALL

Official OWI photographs unless otherwise specified

The following statement was specially prepared for FACTORY *by Arthur D. Newhall, Federal Rubber Coordinator*

THE WORKER who wastes transportation is courting unemployment!

That is just one way of hammering home the vital message which, I hope, management will lose no opportunity to impress upon industrial employees. There may be many other, and perhaps better, ways of stating the case. The underlying issue is vastly bigger than any question of whether certain wasteful workers will find themselves employed or unemployed.

But we must find *some* way of making Americans, and industrial workers especially, *feel* the transport problem as a *personal* responsibility. By transport problem, I mean in this instance

the moving of people from place to place in private passenger automobiles.

The stark fact of the matter, in my opinion, is this: Ultimate victory could depend on whether we handle our slender supply of rubber wisely or foolishly in the crucial months ahead.

I mean that literally. *Failure to make the best possible use of our available rubber-borne transportation today can cost us our freedom, perhaps our very lives, tomorrow.* Probably it is too much to say that we can win the war by conserving rubber. But wasting rubber is certainly one of the ways in which we can *lose* the war.

We have simply got to keep enough passenger cars in commission to provide for essential transportation. If we fail in this, we fail in everything.

Why? Well, the mathematics of the situation are too well known to need much discussion here. When all the smoke of controversy clears away we always find ourselves confronted with one certain outstanding conclusion: If the passenger automobiles in this country stop rolling, all of us can't expect to climb into buses, trolley cars, or trains and ride to work. There just aren't enough public vehicles to take us when and where we need to go.

Too many Americans, I'm afraid, are like Dickens's Mr. Micawber. They think "something is going to turn up" soon in the rubber situation—something much sooner than anything visible in our currently expanded and expedited program for the production of synthetics—which will make conservation now unnecessary. Of course it is true that miracles can happen. Of course we are going to *make* something turn up. No one has more faith than I have in the resourcefulness of American industry. But I still say that *this is no time to bank on miracles.*

Cars Now Vital

We went into the first World War with 4,657,340 automobiles. We didn't *need* most of those cars in that war effort because we still relied primarily on other forms of transportation. We didn't travel so far or so often because commerce and industry were still decidedly localized. Today's 27,000,000 cars and their forerunners have meanwhile transformed economic America incredibly, and so widened our trading and traveling and working areas that the loss of our automobiles would seriously cripple our basic economy.

Yet cars are being lost right now, and they will be going off the road faster from now on. We are just entering the critical period during which it will be nip-and-tuck to see whether, by strict conservation, judicious distribution of our remaining new tires (less than one tire for every third car), and consummation of plans for substitute tires and recapping, we can "keep 'em rolling" for the duration.

Like any personnel question which affects production, this is just as much a management problem as materials handling, plant layout, production control, machine maintenance, or work simplification.

The right number of cars in your parking lot, to you, mean *production*, just as to your men and women they mean jobs. I welcome this opportunity to emphasize that fact to management through FACTORY, because I believe that America's industrial management men could be a tremendously influential factor in the conservation of our transportation resources.

By your leadership you can, if you will, get your people from top to bottom to see the real seriousness of the situation. You can, if you will, see to it that they use their cars for essential purposes only and that none of their mileage is wasted. In this crisis, unnecessary use of rubber is unpatriotic, while deliberate waste is nothing short of sabotage and a direct help to the enemy.

Management's Responsibility—EASTMAN

The following statement was specially prepared for FACTORY *by Joseph B. Eastman, Director, Office of Defense Transportation*

WE AMERICANS, alone among the peoples of the earth, have learned to take transportation for granted. To the average American, the right to ride has been a sort of constitutional franchise, like the "four freedoms."

Now we are at war. We are on the road to victory, the hard road to victory, and we are having to learn that nobody has a vested "right" to ride. In fact, we shall probably learn to regard a ride as a privilege—even a bumpy ride in a crowded vehicle.

This is a new thought to Americans. But it doesn't seem to me to be a particularly harsh thought, when one considers the narrow, limited, trans-

Why We Must Save Cars and Tires

TODAY — 7 out of 10 typical industrial workers depend on cars to get to work, 2 use public transportation, and one walks

NEXT JANUARY — out of every 10 tires on workers' cars today, 4 will be worn out

AUGUST, 1943 — 8 out of every 10 tires will be worn out; public transportation will be available to only 4 out of 10 workers when their cars give out

Source: West Virginia Road Commission Survey

Group Riding Triples Car Life

PEACE-TIME PRACTICE — 3 cars take 5 persons to work (1.6 persons per car) for 18 months (average life expectancy of each car)

GROUP RIDING — same 3 cars (used in weekly rotation) transport the same 5 persons (5 to a car) for 54 months

portation-less lives to which millions of Europeans and Asiatics have been accustomed since birth.

Transportation is one of the precious commodities of a nation at war, a thing to be conserved and allocated like any critical raw material. That is the view which, I hope, industry will take in its task of helping to save our transportation.

FACTORY has asked me to mention some of the major points which I particularly wish management to understand. This I am glad to do, for I feel that we can hardly hope to solve this problem unless management takes the lead in group riding and plays a highly cooperative part in community plans for staggering hours. Transportation of workers today is an integral part of the production line, and management's responsibility in this connection cannot be questioned.

The Office of Defense Transportation knows of no sound reason for supposing that some miracle will happen which will make the conservation of tires and cars and trucks unnecessary. Moreover, the problem is not simply one of tires. We face a serious shortage of automotive parts as well. And we must never forget that no more new cars are being built.

From the many reports received by ODT of successful attempts on industry's part to conserve transportation, certain lessons can be learned. Our conclusions are far from complete, but here are a few which I believe to be valid:

1. Group riding succeeds best when management solicits and utilizes the active cooperation of labor. Indifference, or mere acquiescence, will defeat the best of plans. There is a big "selling" job to be done.

2. The true objective of group riding is the *maximum* use of the *minimum* number of cars. If we simply crowd all our automobiles with people who formerly took buses, or trolley cars, or walked, we accomplish nothing.

This has happened in instances where group riding was undertaken with the best intentions in the world. It can happen when management decrees, as some have done, that no cars will be admitted at the plant gates unless they contain more than one rider. Management must go further and ascertain that the additional riders represent a *real* saving in transport.

Here, a trifle over-simplified perhaps, is a definition of the true objective of group riding. Let us say that there are three cars in the same neighborhood which have provided transportation for five persons, or 1.6 persons per car, and that each of these cars has a life expectancy of 18 months.

Now, with group riding, these five persons decide to ride to work in one car, using each of the three cars in rotation for periods of one week each. This is ideal group riding. These people have increased the period during which all will ride from 18 months to 54 months. But it is ideal only *if* the two cars not used by the riders remain in their garages in the idle interim.

I think it perfectly fair for the sponsors of group riding to insist that there be no waste driving. A promise to avoid useless driving might well be included in the pledge which workers sign when they agree to undertake group riding.

3. Effective group riding does not end with the swapping of rides. It begins there really. As more and more cars break down and drop out of the picture, we come closer to the second phase, which is the pooling of the physical parts of transportation. Let us say that one tire wears out on a car and the owner, unable to replace it, takes the car off the road. It would be a shameful waste for the three remaining tires to deteriorate on the rims in his garage.

Management could arrange to pool

all such surviving tires—and parts, too—and maintain a central exchange at the factory from which workers can purchase replacements.

4. Insistence on careful maintenance of cars is essential. The sponsors of group riding should insist on rotation of tires; encourage frequent check-ups on tire inflation; point to the need for having cars greased and the oil changed and urge the regular examination of brakes. Loose brakes are dangerous. Brakes that "grab" waste rubber.

5. The recapping of worn tires at the proper time should be insisted upon. This is vital. When a tire is worn beyond a certain point there is no further hope for it. If caught in time, it can be recapped at least twice. Millions of tires are close to that critical state now, so there is no time to lose.

Group riding, when all is said and done, is not the only answer nor the final one for the problem of worker transportation. Despite our efforts to conserve, the number of our available automobiles will dwindle rapidly.

Thus, we must realize that a heavy proportion of worker traffic will be thrown over to our already overburdened mass transportation facilities. Under present schedules, our trolleys, buses, and trains could not possibly cope with the whole load; nor can we afford to devote large quantities of critical materials to the manufacture of more public vehicles if there is any other possible way to meet the situation.

The staggering of hours to reduce peak loads offers the most direct means of increasing the effective carrying capacity of existing facilities. The success of this vitally important activity depends absolutely on the full cooperation of industrial management with local utilities companies, merchants, and officials.

So much for what, with most plants, will be the immediate problems of transportation. What are the longer-range considerations? I think the managements of plants not served by existing facilities should consider the possible necessity of subsidizing mass transportation or developing their own facilities as feeders to established transit lines. Some plants may find their own uses for large-capacity passenger trailers, constructed from non-critical materials. Another promising expedient is that of lengthening passenger cars to accommodate 15 people. Still another long-range consideration is that of the exchange, between managements, of employees who currently ride abnormally long distances to work when there are plants closer to their homes where they might be employed.

The Office of Defense Transportation looks to industry with confidence that it will help in every way to meet the serious problem of worker transportation. We believe industry will display its typical American ingenuity in ways in which we cannot yet foresee. We shall be glad to hear from you of any ideas, suggestions, and improvements in transportation-saving programs which you may develop as you go along.

How Lockheed-Vega Meets the Challenge

LOCKHEED-VEGA'S tremendous West Coast aircraft organization attacked the worker transport problem early and hard on every possible front.

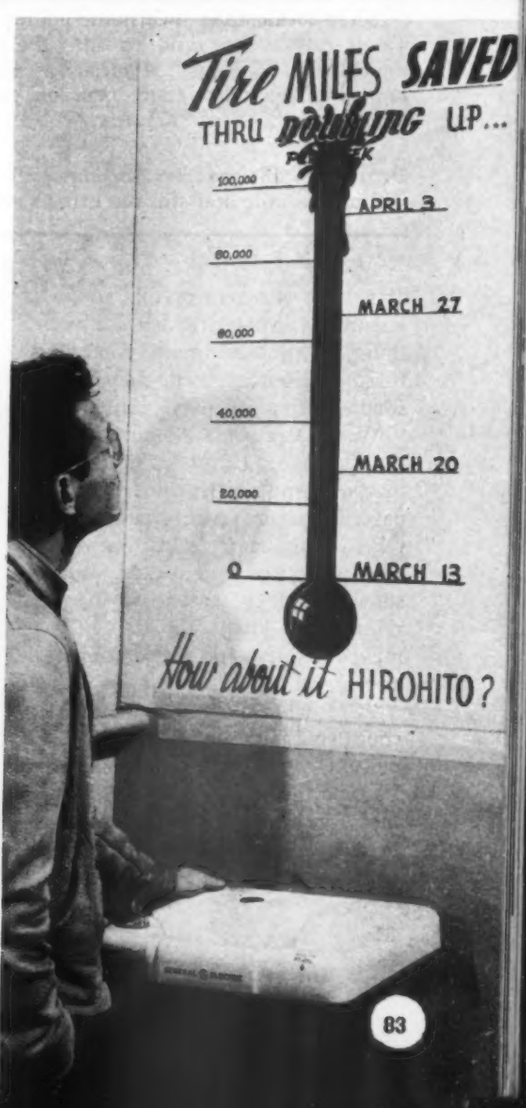
Group riding has raised average employee car occupancy as much as from 1.5 to 3.7 in some departments. Staggering of hours, worked out with transit lines, merchants, and neighboring employers, enabled the company to arrange 18 special bus lines, underwriting some, to connect the plant with nearby railheads.

Lockheed also bought bicycles under a quota allotment from OPA and dispensed them to employees on easy terms. Exchange of personnel has been worked out between the managements of the Lockheed and Vega plants to reduce travel distances of hundreds.

The percentage of employees depending on cars has been cut, to date, from 91.5 to 83.8. Thirteen minutes have been clipped from the time needed to dissolve traffic jams at shift-changing time. Below, the "rideteria" where employees swap rides.

Buses like the one above are part of the 18 new lines serving Lockheed-Vega plants, thanks to staggered hours and company subsidy plans. Buses make circuit of all plant gates, then run straight to designated railheads. Below, a night shift "bike brigade" takes off. Workers who live within 4 miles of plant may buy bikes from company which has agreed to buy them back at end of emergency. Constant publicity in employee magazines and posters throughout plants (right) has made workers conscious of the gains to the war effort and to themselves which conservation of transportation makes possible. Employees have cooperated willingly. Not long ago members of the workers' Saddle Club asked the company to provide 100 horse stalls. The company took plan seriously and will probably comply

(Article continued on next page)



Swap-Ride Formula as Used by Kalamazoo

1. From payroll records, make out a questionnaire for each employee. Fill in name, address, telephone number

2. Sort cards according to departments

3. Give each department head the cards for workers under his supervision; make him responsible for obtaining all required information

4. Have department heads return filled-in cards to you as soon as possible

5. Sort cards as follows: (a) Workers who walk or ride bicycles; (b) ride bus; (c) ride with someone else; (d) drive their own cars

6. Obviously workers in classifications (a) and (b) require no further attention. From here on you work only with cards in classifications (c) and (d)

7. A map of the territory embracing home locations of most of the employees should be ruled off into sections. Half-mile sections provide a reasonable working basis. Assign a number to each subdivision. Find out in which "section" each employee lives. Indicate correct "section" number in upper right-hand corner of questionnaire card.

(An alternate method is to post "section" maps where they can be referred to by all employees. Then employees are asked to locate their own home addresses and to note in which sections they reside, putting the proper numbers on their cards. This method means preparing several maps, but eliminates office time spent on clerical work in the location of "section" numbers)

8. Group all cards by "sections." If some workers live within one mile and still use cars to and from work, take cards out and have department heads or foremen (or shop stewards) urge such workers to walk. They can without hardship

9. Make lists of employees by "sections." Give name, address, and telephone number

10. Post lists on bulletin boards. Also, post instructions urging employees whose names appear on lists to start their swap-ride groups at once—with their neighbors living in the same or adjacent "section." Posters help greatly in putting "story" across

11. Request that one member of each swap-ride group give you names of workers in his group. Keep a record of groups, and who are members of each group

12. When a worker makes his report, give him pledge cards and windshield stickers for every member and every car in his group

13. After reasonable time, go over lists and see who are not cooperating. Follow up and find out why. Some may be shy and need instructions. Your help will get many of these people started

14. Some employees may live beyond the limits ot your map, and therefore can't be grouped according to your "sections." Group them by towns, along or close to highways leading to plant, etc.

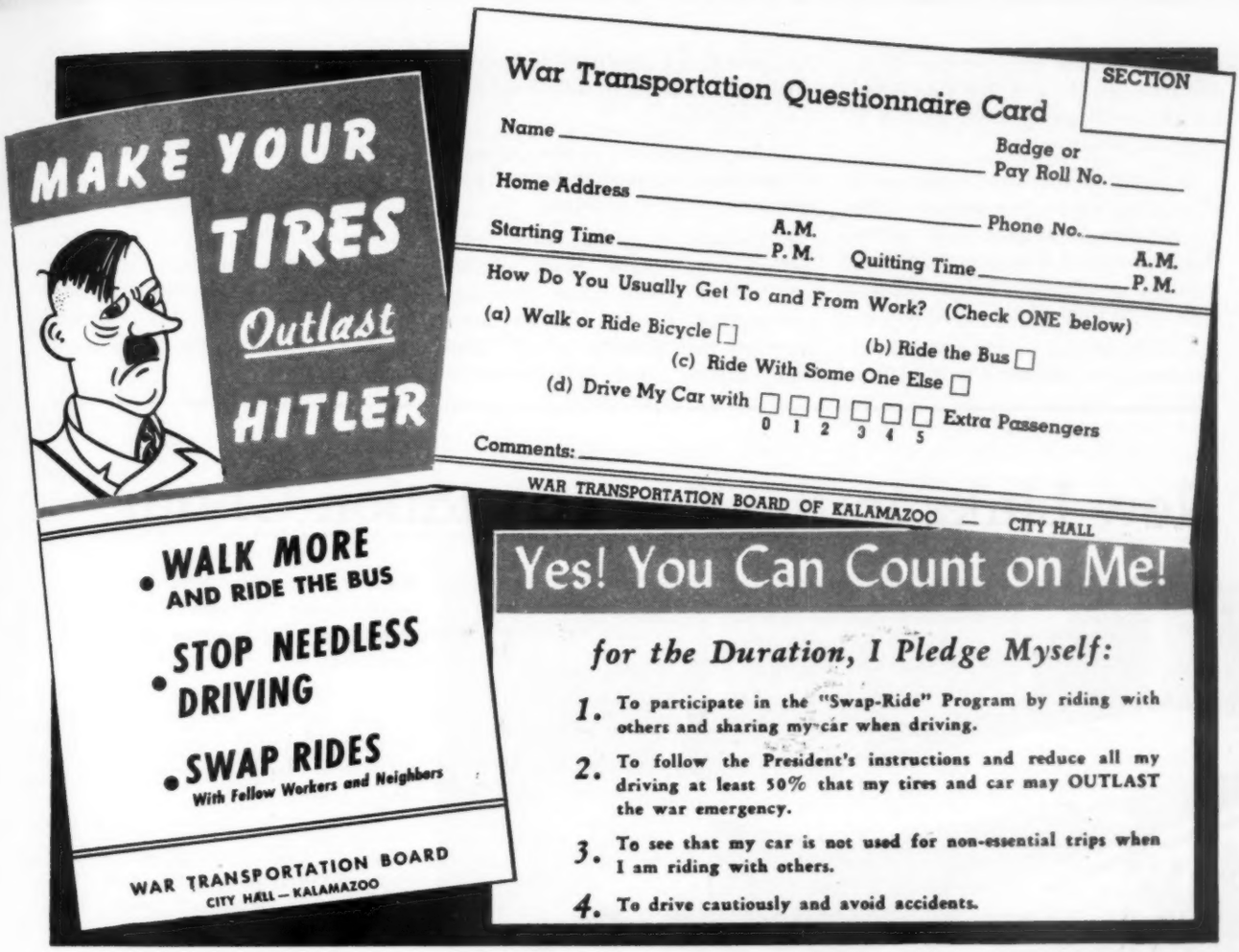
15. Workers in your plant who just can't be grouped, for one reason or another, can often be teamed up with workers in plants adjacent to yours. If nearby plants also operate swap-ride programs, exchange lists of such workers. Many groups can be formed this way

THE WAR TRANSPORTATION BOARD of Kalamazoo, Mich., tackled the worker transport problem on a community basis, developing a swap-ride program adaptable to all the city's plants.

W. J. Williams, Administrator of the Kalamazoo Board, set up the Kalamazoo formula as it appears on this page. Williams points out that the OPA ruling, which holds that workers who want new tires or recaps must show that they participate in group riding, puts "teeth" in any management's request for cooperation. He also urges:

"Get labor behind the move. If your plant is unionized, solicit the 100 percent cooperation of various locals. Use your plant paper. Call mass meetings at which both labor leaders and executives can talk plainly on the gravity of the situation."

Kalamazoo's complete and clever promotion campaign, as typified by the poster above, makes workers see the advantage of swapping rides. Windshield stickers are also used to denote participation


MAKE YOUR TIRES Outlast HITLER
War Transportation Questionnaire Card
SECTION
Name
Badge or Pay Roll No.
Home Address
Phone No.
Starting Time A.M. P.M.
Quitting Time A.M. P.M.
How Do You Usually Get To and From Work? (Check ONE below)
(a) Walk or Ride Bicycle
(b) Ride the Bus
(c) Ride With Some One Else
(d) Drive My Car with 0 1 2 3 4 5 Extra Passengers
Comments:
WAR TRANSPORTATION BOARD OF KALAMAZOO — CITY HALL
• WALK MORE AND RIDE THE BUS
• STOP NEEDLESS DRIVING
• SWAP RIDES
With Fellow Workers and Neighbors
WAR TRANSPORTATION BOARD
CITY HALL — KALAMAZOO
Yes! You Can Count on Me!
for the Duration, I Pledge Myself:
1. To participate in the "Swap-Ride" Program by riding with others and sharing my car when driving.
2. To follow the President's instructions and reduce all my driving at least 50% that my tires and car may OUTLAST the war emergency.
3. To see that my car is not used for non-essential trips when I am riding with others.
4. To drive cautiously and avoid accidents.

Kalamazoo gives workers a clear statement (above, left) of "the reasons why." Right, Kalamazoo swap-ride questionnaire (see formula on the opposite page). Pledge card hits at non-essential driving

Providence Proves That Staggering Pays

AMONG THE FIRST CITIES to feel the tension of an approaching shortage of mass transportation were highly industrialized Providence, R. I., and its companion communities, Pawtucket and Woonsocket. All three are served by United Electric Railways Company.

A survey last spring showed that the transit company had only 20 vehicles on reserve in its whole fleet of 453 buses and street cars. By early June, peak loads on the transit system were running to 22,800 passengers per hour, dangerously close to the estimated top limit of 25,000.

The Providence Civilian Defense Council got busy on a staggered hours plan. By August 1, Providence was able to report that 50 percent of all the city's workers using public transportation were on a staggered hours basis. The resulting increase in the transit lines' carrying capacity is estimated as being the equivalent of 40 public vehicles. Matched against the company's earlier estimate of its reserves—20 vehicles—this means beyond doubt that, without staggered hours, the area's transit facilities would have been seriously overtaxed by now.

Providence officials agree that the already considerable success of the plan would not have been possible without the cooperation of industrial employers. Providence now is driving toward a goal of 100 percent participation by September 30. In this the complete cooperation of industry will obviously be required.

Here are some reasons why Providence industry must cooperate and why, if Providence is typical, all industries in all cities must join actively in staggered hours plans:

1. The 50 percent success achieved by staggering to date brought a corresponding increase of less than 10 percent (40 vehicles) in the carrying capacity of the transit lines; thus 100 percent participation can be expected to realize a maximum gain of only about 20 percent.

2. Against this, Providence officials estimate that the daily total peak load on the transit system will climb, by November, to 85,000 passengers—or 58 percent above the comparable figure for last year.

3. Officials believe the load on pub-

lic transportation will *continue* to increase despite the fact that Providence has promoted group riding as well as staggered hours.

By and large, industrial management is not expected by government to take the initiative in staggered-hours plans. But government *does* expect management to participate fully. Officials urge observation of these rules:

1. Fill out and return promptly all questionnaires submitted by local War Transportation Committees seeking information on which to base staggered-hours programs.

2. Act immediately to change hours in the plant on request from representatives of these agencies.

3. Coordinate group riding with staggered-hours plans. Some officials believe that group riding, if newly contemplated, should be held in abeyance by managements which have been advised that staggered-hours plans are about to become effective in their communities.

4. "Sell" staggered hours to employees by every possible persuasion.

Officials say that women resist changes which get them home later, while men dislike getting up earlier in the morning. But from Providence comes this word: "Ninety-five percent of the people are willing to cooperate once they realize the purpose of staggered hours."

New Links in the Transportation Chain

Photograph by courtesy of Fruehauf Trailer Company

A war development is this big trailer bus designed by a Detroit manufacturer. Made largely of non-critical materials (like ODT design shown in July *Factory*, page 67) it can carry 100 passengers

This was an ordinary sedan until it was boosted to 15-passenger size by Francis W. Feeney (opening door, below), president of Fitzjohn Coach Company. The extension took only 300 pounds of steel

NEW TIMES, new methods. Experts predict that the war transportation crisis will evolve some of its own solutions.

In some cases managements have already, through necessity, undertaken to subsidize public transit lines. Transit experts believe this practice will become more widespread.

Eventually managements may be forced to invest in equipment of their own, if obtainable, quite apart from subsidization of transit lines. Thus all developments are of interest to industry, although it is too soon to judge their relative significance.

Trailer and Other Buses

First of the oversized trailer buses was one made up from ODT design (see *Factory* for July, page 67). The chief advantage of this 141-passenger "war model bus" is the fact that it can be built quickly and that non-critical materials are principally used. Chief limitations: Unsuitable for short hauls yet at full capacity bus itself becomes a sort of central loading point which might require some form of "feeder" service.

Trailer manufacturers have also designed models in which conservation of critical materials is combined with especially large carrying capacity. One is the 100-passenger Fruehauf, illustrated on this page, and another is the Coach Trailer Equipment Company's conversion of a standard coach trailer which can carry 77 to 100 passengers depending on choice of alternative seating arrangements.

Other manufacturers have worked

out smaller passenger units adapted to standard truck chassis designs. Ace Motor Coach of Albert Lea, Minn., has developed a 15-passenger bus converted from a light panel truck. The Kammer Body Company of Jamaica, N. Y., has built a 35-passenger open-air bus, with pull curtains for bad weather, mounted on a standard truck chassis of heavier design.

Extended Passenger Cars

Some 300,000 new cars are "frozen" in showrooms. A device that might triple their carrying capacity is advanced in the new "Defense Workers Coach" which is a standard passenger sedan extended in length to 22 feet with a capacity of 15 persons. Only 300 pounds of steel is required. The body work is of wood and non-critical materials.

The designers believe that, with care, this vehicle will run 15 or 17 miles to the gallon of gasoline and that the proper type of tire should last 20,000 to 35,000 miles. The design is that of the Fitzjohn Coach Company of Muskegon, Mich.

Bicycles

Some companies are already buying bicycles and selling them to employees. Bikes will be scarce, however. Some 230,000 were on the shelves in July. WPB's curtailment order allowed for 100,000 more in July and August, and 10,000 a month thereafter.

OPA's new eligibility requirements are much the same as those governing civilian applicants for tires and extra gasoline. Essentiality is the chief test. Most war workers should qualify. However, the prospective purchaser may not obtain a bike if he still has a usable car. OPA is out to see that no bicycles are used simply to preserve cars for non-essential driving. Purchaser must further show that his bike will save him at least three miles of walking that could not be avoided by using public transportation lines.

What of Group-Driver Liability?

DOES GROUP RIDING expose the driver to extra financial hazard under the liability laws?

Washington officials say it does not. While neither government executives nor insurance groups wish to be quoted directly, they point out that it is fundamental in the common law that a *guest* passenger in an automobile cannot recover from the driver for injuries sustained in an accident *unless* negligence, willful or wanton misconduct, or drunkenness on the driver's part can be proved.

In 28 states, in fact, action against the driver is specifically barred by law except in cases involving some form of gross negligence. The 28 states are: Alabama, Arkansas, California, Colorado, Delaware, Florida, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Montana, Nebraska, Nevada, New Mexico, North Dakota, Ohio, Oregon, South Carolina, South Dakota, Texas, Utah, Vermont, Virginia, Washington, and Wyoming.

Not Drivers-For-Hire

The driver would not be relieved of responsibility, of course, *if* he were operating a carrier-for-hire. But *bona fide* group drivers are *not* regarded as operators of public passenger vehicles. Officials admit that some drivers might be so classified under an extra-stringent interpretation of certain state laws, but only then in instances when an exchange of money takes place among ride-swappers. And no such interpretation has as yet been drawn, nor is it likely to be.

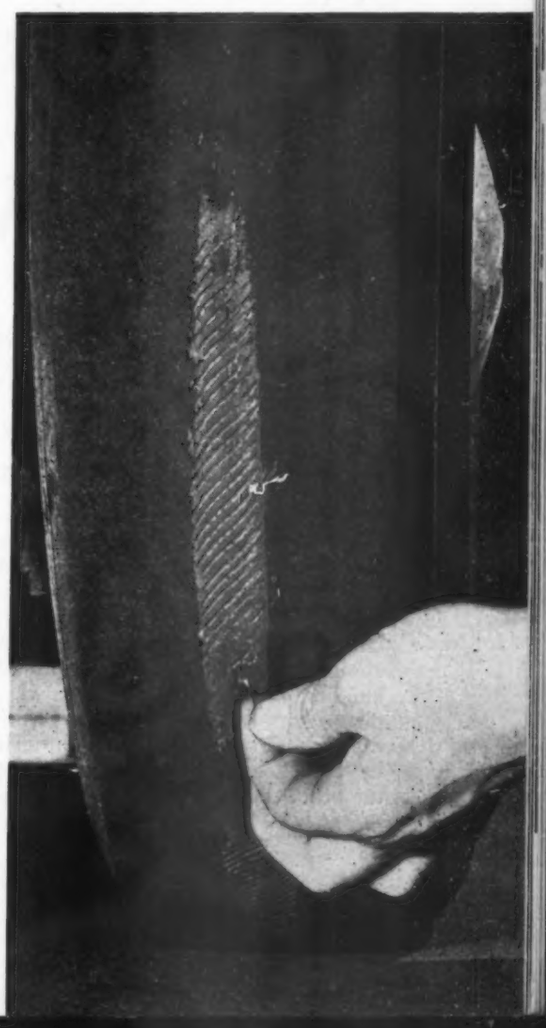
As a matter of fact, state motor vehicle administrators, state highway officials, state police chiefs, and most local officials are doing everything in their power to *promote* group driving. They are heartily committed to its support through their affiliation with the system of local War Transportation Committees (of which 600 now exist) and State Highway Traffic Advisory Committees set up under the National Highway Traffic Advisory Committee to the War Department to implement ODT's program for the conservation of transportation. Finally, the protest which might possibly come in peacetime from commercial operators of public vehicles has naturally been stilled by the war emergency.

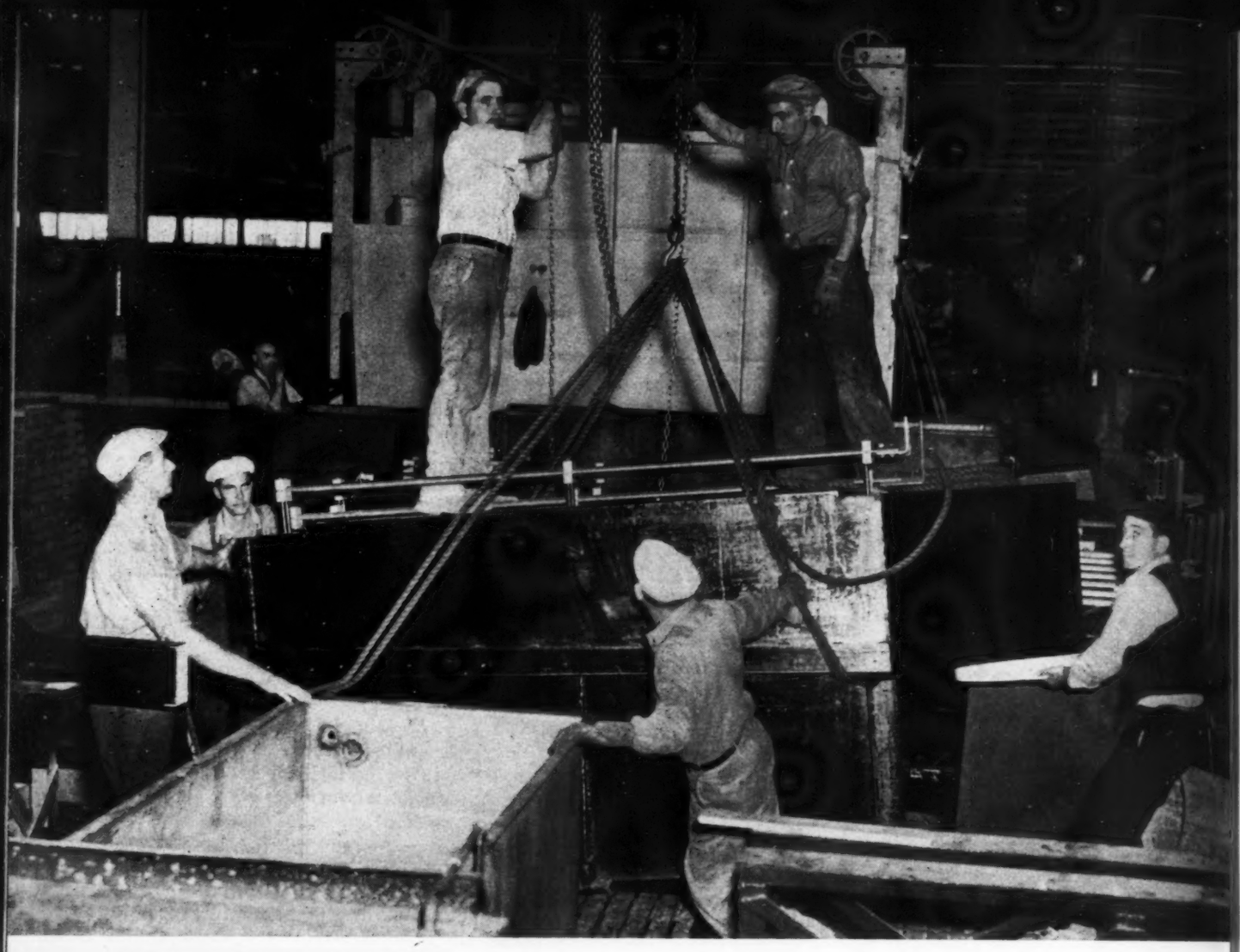
An Advantage Seen

Off the record, one Washington official expresses belief that guest passengers are likely to prove an actual advantage to the driver in most cases of accident. He points out that the guest is potentially a witness in the driver's favor if a collision occurs.

At all events, neither the liability nor the licensing question has been a factor in group riding to date. A WPB study of group riding projects undertaken by War Production labor-management committees revealed only one instance in which the liability question was even discussed as a possible obstacle.

Surveys show 40 percent of U. S. war workers' tires will wear out in 6 months, 80 percent in a year





Plating tank is lowered into place on its special pre-positioned supports. All drains, duct work, and piping are below the floor level, thereby allowing unobstructed space for overhead handling

Moved Without a Shutdown

Problem was to get a second plant into operation, keep original plant running, have both working as a unit in quickest possible time. It was done—by dint of coordination, cooperation, some tears, much sweat

When we built our Buffalo Airport Plant, it was decided to operate it and the Kenmore Plant, not individually with each making a complete airplane, but as a single unit with each plant doing approximately half the job of building one plane. Both plants were planned so that materials or work would enter at one end, move through by the shortest route, and leave at the other end—from one plant as finished fuselages, from the other as finished airplanes.

All this necessitated considerable rearrangement of the departmental set-up in the existing plant, and required careful planning by the plant layout department so that the old plant could go right on producing and the new one could begin producing without delay.

The story of this initial planning has been told in an earlier article.* The next task was to make all the necessary preparations for the move and set-up of two plants, so that, when the time came, everything could be easily placed.

First, every machine or piece of equipment shown on the layouts was given an item number so that it could be positively identified. This was done by departments, starting at one end of the plant and working in order towards the other. In this way, each department had all its equipment within a certain numerical range. For example, the machine shop numbers ran from 1500 to 2000. Thus

* *Rearranging Plants and Equipment*, August, page 90.

Biggest chore of all was to move and erect this 3000-ton hydraulic press. Total weight, 180 tons. Weight of largest piece, 80 tons

ARTHUR PETZON, Assistant Factory Manager
and HARRY ROSENBERG, Plant Layout Engineer
Curtiss-Wright Corporation, Airplane Division, Buffalo

a milling machine numbered 1620 was known to belong in the machine shop, and not in the toolroom. The numbering also served to determine the relative position of a machine. Machine 1621 would naturally be somewhere near machine 1620.

After each machine was numbered on the layout tracing, it was listed on a special form (Figure 2) showing item or tag number; the DPC (Defense Plant Corporation) number, if a new machine; the purchase order number, if newly purchased; name and size of machine; department it was to be placed in; promised delivery date, if new; date received; and date it was put in position.

From this list a linen tag (Figure 1) was made up for each machine. Linen was required to withstand the oil and dirt accumulated from the machines. The tag carried the following information:

1. Department number where machine was to be located.

2. Item number of machine, taken from layout drawing.

3. Name and size of machine.

4. Name of department where machine was to be located, and plant layout drawing number of same.

5. General area in which located, designated by column numbers.

Thus, when a new machine is delivered, its purchase order can be located from the special form sheets. They will show the tag number of the machine. The tag is then attached to the machine so that anyone who looks at it will know where it belongs.

In order to get all new equipment to work as rapidly as possible, the company rented a vacant factory building near the Kenmore Plant. Here all machinery that was delivered before the new plant was far enough completed to receive it, was set up and put into operation. Some machinery that could not be operated was kept in storage at that plant. It was known as the Fowler Plant. In this way the company could train men and get machinery to work before permanent places were available.

All Machines Tagged

After all form sheets were completed, and all tags were written, the plant layout department invaded the Fowler Plant to tag the machinery there. All was not as easy as it sounded. It was often difficult to find out the purchase order number under which a machine was delivered. Also, when there were several machines of the same kind on the same purchase order, it was hard to find out their departmental distribution. There could be no mistakes in this work; every machine had to be tagged correctly to insure its being installed in the proper position to do the work for which it was purchased.

Just about the time the tagging was completed at the Fowler Plant, the first strip of concrete floor in the Airport Plant was ready for use. With the roof only partly on, sidewalls half completed, and just a strip of floor 150 by 300 feet suitable for use, the plant layout department started work.

The first task was to empty the storeroom at the Fowler Plant, and at the same time set up any machinery that could be located in its permanent position.

An outside contractor had been hired to handle trucking, rigging, and all installations. The plant layout department directed activities—where to put the machines, how to install them, when to do certain jobs. It also figured how many men and how much equipment would be required each day to handle the job as it progressed and grew.

As the machines started arriving from the Fowler Plant, a layout crew began spotting the floor locations with paint, showing the outline of the machine's full size, the item number

taken from the plant layout prints, and the front of the machine, so it would be faced in the proper direction.

Seemingly insurmountable interferences soon became commonplace. Building material was piled all over the floor, cold and dampness made hands numb, dust and roofing tar fumes made breathing a difficulty, and everywhere one turned something or someone was in the way. However, close cooperation with all the building contractors helped keep things moving, and floor markings were painted in, accurate to the nearest inch, as pipe covering and paint from the workers in the trusses overhead fell down the necks of the layout crew below.

As time progressed, the crew kept right behind the contractors. As soon as the concrete floor was dry enough to walk on, the layout crew was right on it spotting in the machinery. The record number of machines spotted on the floor in any one day was 105, which is a lot of machines in any man's plant.

All the time the spotting was going on, machinery was being delivered from the Fowler Plant, and the new machinery was coming in every day from the many vendors. These new machines had to be tagged the same way as those at Fowler. Any machines that could be placed immediately, were. The others were stored in groups, according to where they were to be permanently located.

In order to withstand the heavy loads of the large machinery, the concrete floor had to set ten days before machines could be placed on it or transported over it. As more and more floor space became available, operations became more systematic and proceeded on a larger scale. When

(Continued on page 218)

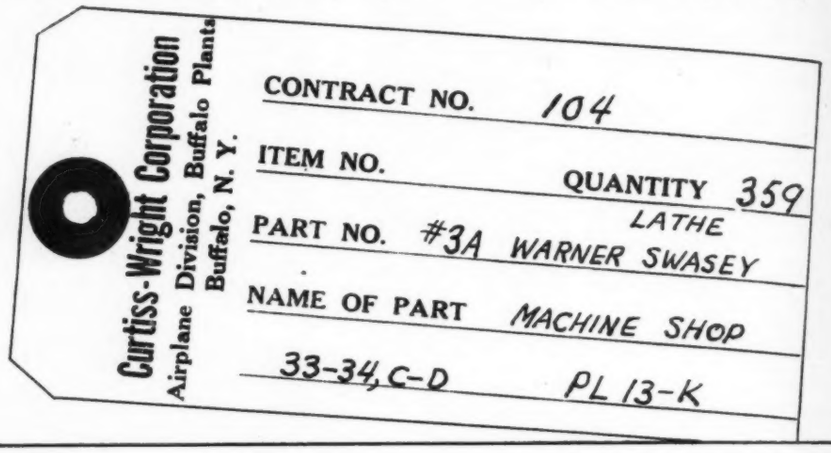


Figure 1. Standard Curtiss tags —made of linen to withstand grease and oil—were pressed into use during move. To see how tag was used, read "Dept. No." for "Contract No.," "Name" for "Part No.," "Name of Dept." for "Name of Part." Left-hand entry on bottom lines gives location by column numbers; right-hand entry is layout drawing number

Machine Shop

PLANT No. 1

Tag No.	DPC No.	Purch. Ord. No.	Name and Size of Machine	To Dept.	Prom. Del'y	Date Rec'd	Date Placed
682		PRES.	#33 HYDRO-SCREW SUNDSTRAND	4			7-1
683	10448-	20104-B	BAKER INVERTED OLEO DRILL	4	6-25	6-28	7-2
684	10449	20104-B	" " " "	4	6-30	6-30	7-2
685		PRES.	" " " "	4			7-2
686	11573	20401-B	#56 SUNDSTRAND CENTERING MACHINE	4	5-26	6-15	6-25
687	10345	20031-B	CINC. 28-60 VERT. HYDROTEL MILL	4	7-30	7-15	7-15
688	10976	#21332-B	#3 REED PRENTICE MILL & DIE SINKER	4	5-15	6-5	7-15
689		PRES.	#25A DEFIANCE HORIZ. BORING MILL	4			7-16
690		PRES.	#25A " " " "	4			7-16
691	11732	20559-B	UNIVERSAL BORING MILL 3" SPIN.	4	12-12	12-1	12-3
692		PRES.	#33 HYDRO-SCREW SUNDSTRAND	4			7-16
693		PRES.	18"x45" FAY AUTOMATIC LATHE	4			7-18
694		PRES.	12"x45" " " "	4			7-18
695			SURFACE PLATE	4			7-18

Figure 2. Move data were entered on forms like this one; identification tags (Figure 1) were made from these data. Note that DPC (Defense Plants Corporation) numbers on the form are fictitious

Motion Study—It Works in the Core Room, Too

Right- and left-hand charts reveal chances for improvement. On one job, described here in detail, it was possible to eliminate 272 unnecessary motions

WILLIAM S. HANSEN, Production Engineer, Hart-Carter Company, The Lauson Division, New Holstein, Wis.

THAT THE PRINCIPLES of motion study can be applied to any industrial operation with good results, has been proved long ago. However, an unusual application is always valuable, particularly when the operation is one such as coremaking to which apparently little attention has been paid.

The motion study method used on this job is relatively rough compared with micromotion study which takes into consideration even the movements of the eye; for our purposes a more detailed study would be too expensive. We have found that simple right- and left-hand charts will reveal the majority of possibilities for improvement.

Brief Descriptions

Our charts are the simplest imaginable, with a wide column and a narrow one for each hand. In the wide columns the methods man writes a brief description of each element—for instance, "position wire in sand." The narrow columns are for therblig symbols that classify the elements as "transport loaded," "use," "grasp," etc. The old method (see illustration) took ten sheets; the new one, five. The reduction in number of sheets required to analyze the job supplies a rough idea of the savings made.

On one job we studied, the core made weighs about 8 pounds. It is 3 inches high, 14 long, and 12 wide. This core is made of the conventional sand mixture—silica and bank sand—with core oil and flour for binder.

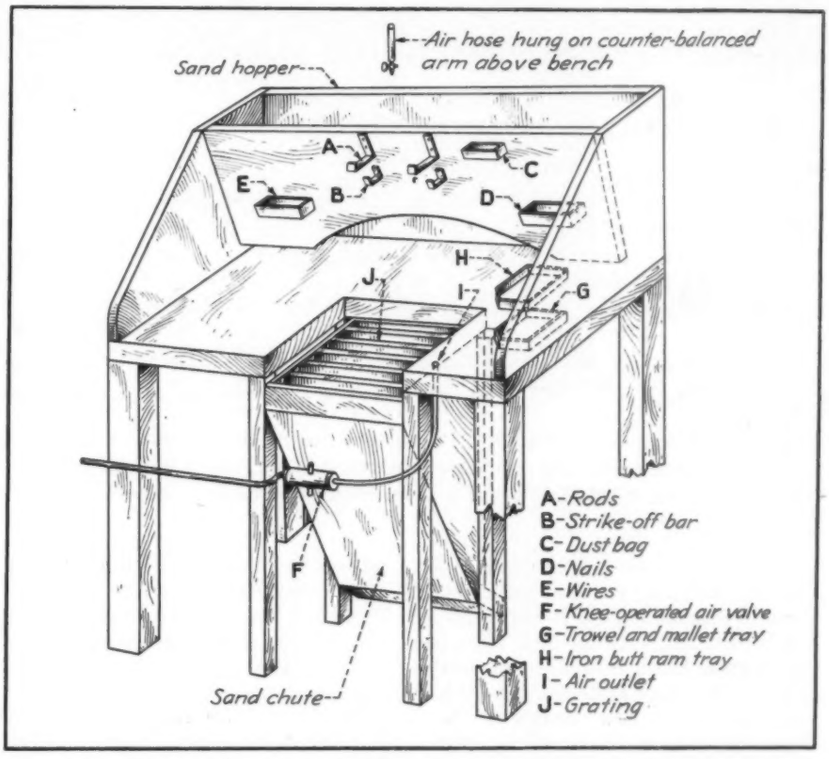
In the old method an ordinary flat-topped bench was used. The air hose was hung on a nail at the left side of the operator. Nails and wires used to reinforce the weak projections in the core were kept in boxes placed helter-skelter on the bench top.

A wooden ram was used to pack the sand. Because of its light weight and because the business end of the ram was rounded, it required 21 rams to pack the sand properly. This wooden ram was replaced with an iron one with a flat bottom about 6 inches in diameter. It is so much heavier that only six rams are now needed to pack the sand—with a big saving in time.

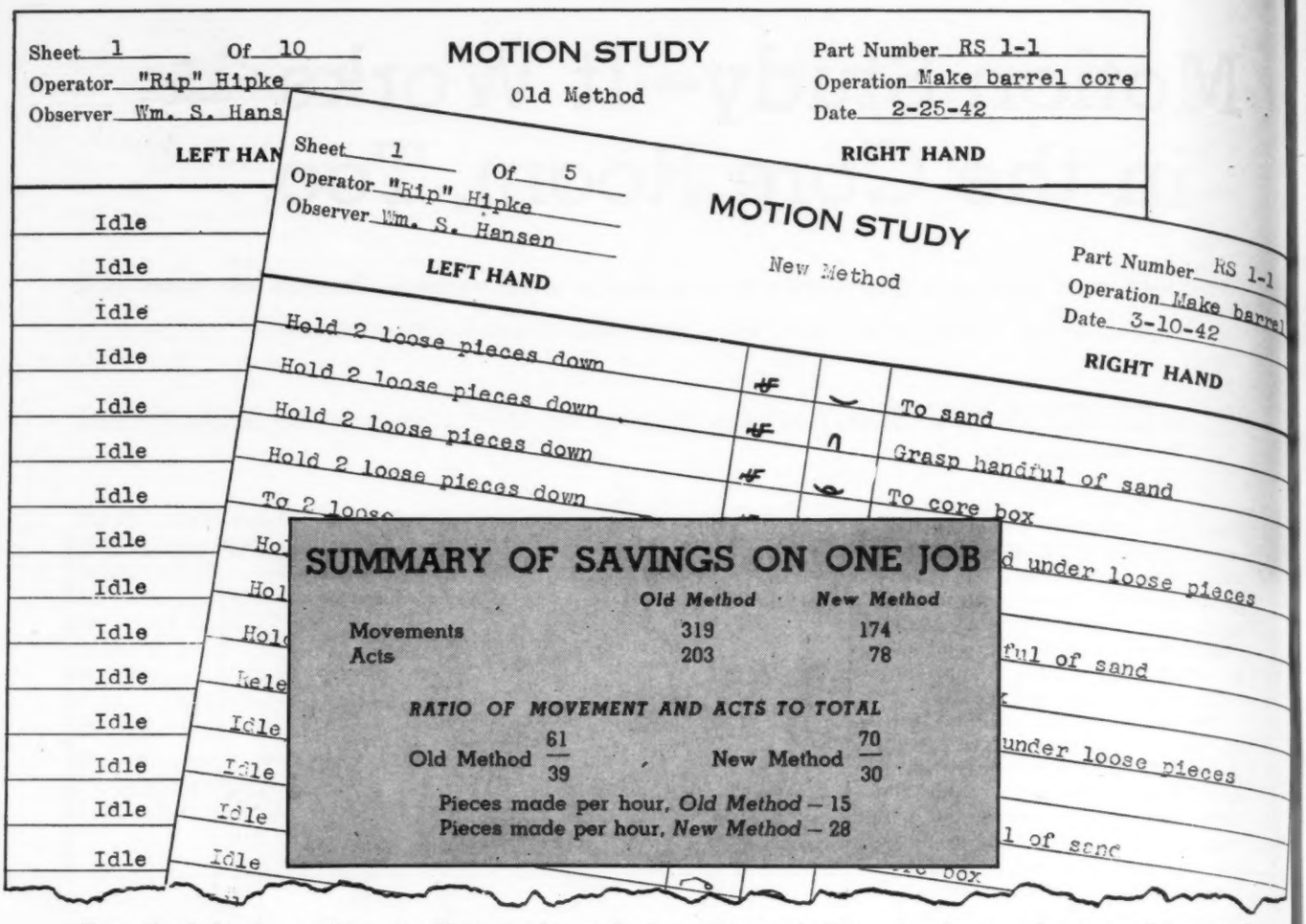
Analysis of the process charts directed our attention to the fact that the coremaker was using a small stick to tuck the sand under some projections in the core box. That caused us to question why the coremaker's fingers would not be equally effective and much faster. We got the inevitable answer that the stick was the only way the sand could be properly tucked; however, we were able to prove to the coremaker's satisfaction that he could use his fingers.

This attitude of questioning and trying other methods was used throughout. And as a result of the analysis the core bench shown in the illustration was designed. We ended by eliminating 272 unnecessary motions. Production was increased from 15 to 28 pieces per hour.

Note that the top of the iron grille



New bench has grille set in so that top of core box is level with top of bench. Coremaker sweeps sand into box with a pulling motion and levels it with a pushing motion that sweeps surplus back to pile



Enough of charts are shown to illustrate the method used in analyzing old and new ways of making core. Note how idle left hand has immediately been put to work. Note also that ten sheets used to record old method have been cut to five in new. Summary shows breakdown of motions and reductions made

is 4 inches lower than the top of the bench. The core box is 4 inches high, and in the old method it was necessary to lift the sand into the box. With the iron grille the top of the core box is flush with the top of the bench, and the coremaker now sweeps the sand into the box with a pulling motion and levels off the sand with a pushing motion, pushing the surplus sand back to the pile.

At the end of this motion his hands sweep directly up to the brackets marked "A" where the rods are stacked. He grasps two rods and carries them to the box where they are placed in the sand. These motions are now graceful and "ballistic," whereas in the old method the motions were jerky and time consuming.

With the iron grille set in the top of the bench, it is now unnecessary to bounce the core box, which had to be done in the old method. "Bounce" means to lift the partially filled box about 8 inches above the bench top and let it drop onto the bench. The impact packs the sand in the corners of the box. Because of the firm support which the iron grille gives, however, it is possible to obtain a solidly packed core just by ramming the sand with the iron butt. This also prevents wear and tear on the bottom of the core box which is made of aluminum —a metal not to be wasted these days. If all core benches were made with a solid top, firmly supported, much of the bouncing could be eliminated and boxes would last longer.

Surface Stays Clean

By using an iron grille the surface under the box is always clean. There is no sand to be scraped away by the coremaker every time he makes another core. The sand that may fall off the edges of the box drops through the grille and down the chute into a box from which the service man periodically shovels it back into the hopper to be used again.

The summary with the charts shows a breakdown of the number of motions and their reductions in percentages. Motions are also broken down into two groups—movements and acts.

"Movements" contribute something to the job. They include *grasp, release load, transport loaded, transport empty, use, assemble.* These motions are the bread and butter of a job.

An "act" is a necessary evil. It contributes nothing really worth while to an operation—but all acts cannot be entirely eliminated. Acts include *search, select, position, unavoidable delay, avoidable delay, balancing delay, pre-position,* and *hold.*

Now a well-designed operation will consist of 80 percent movements and 20 percent acts. The closer one approaches the ideal ratio, the greater the savings one will make. There are operations where the volume of production will not warrant the extra cost of designing it so that there will be an 80/20 ratio. In that case it is best to approach it as closely as possible and stop at that point—which is exactly what we did when we worked out the details of this operation.

More than 300 people daily are attending the "Arms for Victory" show in Dayton. Here, in a barber-shop scene, "Mr. Jones," the manufacturer, explains the problems of converting factories to war work

General Motors Dramatizes War Role of Industry

DRAMATICALLY PRESENTED in a stirring stage play and an exhibit of war products made in General Motors plants throughout the United States, the six divisions of General Motors in Dayton are presenting an "Arms for Victory" show believed to be the first of its kind ever staged.

Primarily designed to give employees and their families an insight into war production problems and to present first-hand evidence of what General Motors employees throughout the nation are accomplishing in producing goods for use in the present conflict, the show later was opened free to the general public.

Dayton General Motors employees and their families represent a total of some 70,000 persons and in the first eleven weeks of showing, attendance ran to more than 175,000 at the stage show alone with men, women, and children continuing to attend at the rate of more than 3000 daily. Additional thousands have visited the exhibit of war wares.

The show graphically portrays what war means to the individual and vividly depicts the indispensable part played in it by those holding the production "battle lines." Other underlying purposes in staging the "pageant of war production" are to dispel ignorance of war issues, to correct misinformation and confusion, explain factory problems of conversion, and to unify action toward winning the war in the shortest possible time.

Engaged in presenting the pageant are 177 people, including a 20-piece orchestra, mixed chorus of 40 voices, and actors who portray various characters including "Nazis," "Japs," "fifth-columnists," American businessmen, war production workers, housewives, children, and clubwomen.

At the Fairgrounds

Presented at the county fairgrounds in a roofed sports arena that has been converted into an auditorium seating 1700 persons, the auditorium show consists of 80 minutes of 38 fast-moving scenes enacted on a three-section stage, newsreel screen projections, the sound effects of war, martial orchestra music, and choral numbers.

Connected with the auditorium by a canopied concourse, a unique fabric-and-metal suspension tent has been set up for the display of sample guns, plane and tank parts, engines, precision instruments, and other war material now being delivered at the rate of $5,000,000 daily from General Motors plants for shipment to United Nations forces on global fronts.

War products shown are authentic pieces and have been placed in the exhibit only because they are early models, "rejects," or have been used for test purposes.

Represented on the committee in charge of the double-barreled production are officers of the six Dayton divisions of General Motors, which include Aeroproducts, Delco Products, Delco Brake, Frigidaire, Inland Manufacturing, and Moraine Products.

All material for the show and the exhibit of armaments has been approved by Army and Navy censors. The double-feature show has met the approval of public officials, industrialists, press, civic leaders, army officers, clergy, and educators, and is believed to have raised the morale of Daytonians and stepped up war factory output.

How the "architecture of concealment" effaces an easy target like the plant below

What Camouflage Can Do

Find the factory if you can before the AA guns get you, is what the industrial camoufleur says in effect to enemy bombers. In this article, a well-known practitioner discusses a problem more of *Factory's* readers may some day face

HARPER GOFF, Warner Bros. Pictures, Hollywood

Photographs by courtesy of Premier Oil & Lead Works of California

IT WOULD BE NICE if the plant manager could instruct the maintenance department to order 20,000 square feet of camouflage material and roll it over the factory like a carpet, thus removing the plant from the landscape as far as visibility is concerned.

But he can't. Camouflage is not like that. It may properly be called *the architecture of concealment*. It is tailor made, custom built, to the last detail. There is no opportunity to employ mass production methods in its design. It is not like a ready-cut home or a pre-fabricated fence that can be bought by the yard and installed according to a page of printed instructions.

On the contrary, local conditions of the terrain—for instance, nearness to the seashore, with its change in actinic light—make it necessary for each job of camouflage to be given individual and specialized attention.

Must Know All Angles

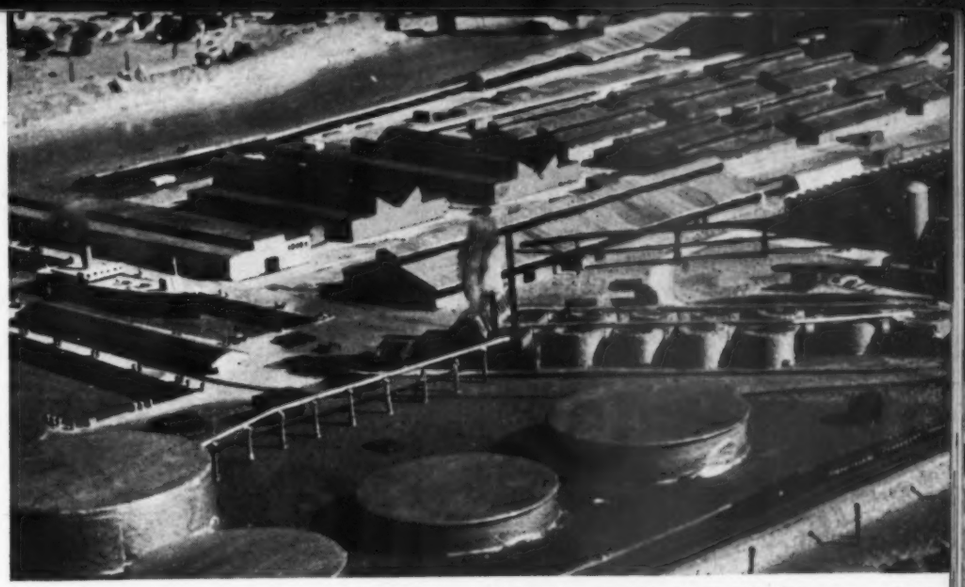
The camoufleur should be on the spot and familiar with the operations of the factory under transformation. He must understand the manner of living of the people in adjacent territories. He must see with his own eyes traffic problems and points of congestion, and should observe from the air the organic structure in the earth that weaves itself like a tapestry across the map.

Further, the camoufleur must be familiar with the type and construction of buildings surrounding the factory. He must know what kind of foliage grows in the immediate area, when it is in full leaf, when the branches are naked, when the sun and fog and rain are most likely to bring about the critical condition of exaggerated visibility.

Clearly, all sections of the nation are not alike in soil, topography, and foliage. It is impractical for a designer, working in one city, to direct camouflage theory and procedure for defense

(*Continued on page 224*)

THE AUTHOR has distinguished himself since America entered the war by designing and supervising the camouflage of West Coast plants, notably one of the great aircraft factories. A set designer for Warner Bros. Pictures, he has studied camouflage for the past three years. He helped to organize the famous Warner Bros. camouflage unit which went into action within three days of Pearl Harbor



Here, in a series of photographs from models, one sees how tough the camoufleur makes it for bombers. Above, plant before camouflage

Low-visibility camouflage paints have altered the scene. Trainshed effect to hide railroad is secured by stretching chicken wire over framework and covering it with painted "garnish." From bombing altitudes such painting may well confuse enough to frustrate the attack

Below, total camouflage. Nets, natural and artificial foliage, and plywood shapes combine to confuse. Costly, but conceivably worth it

Women? They're Here to Stay

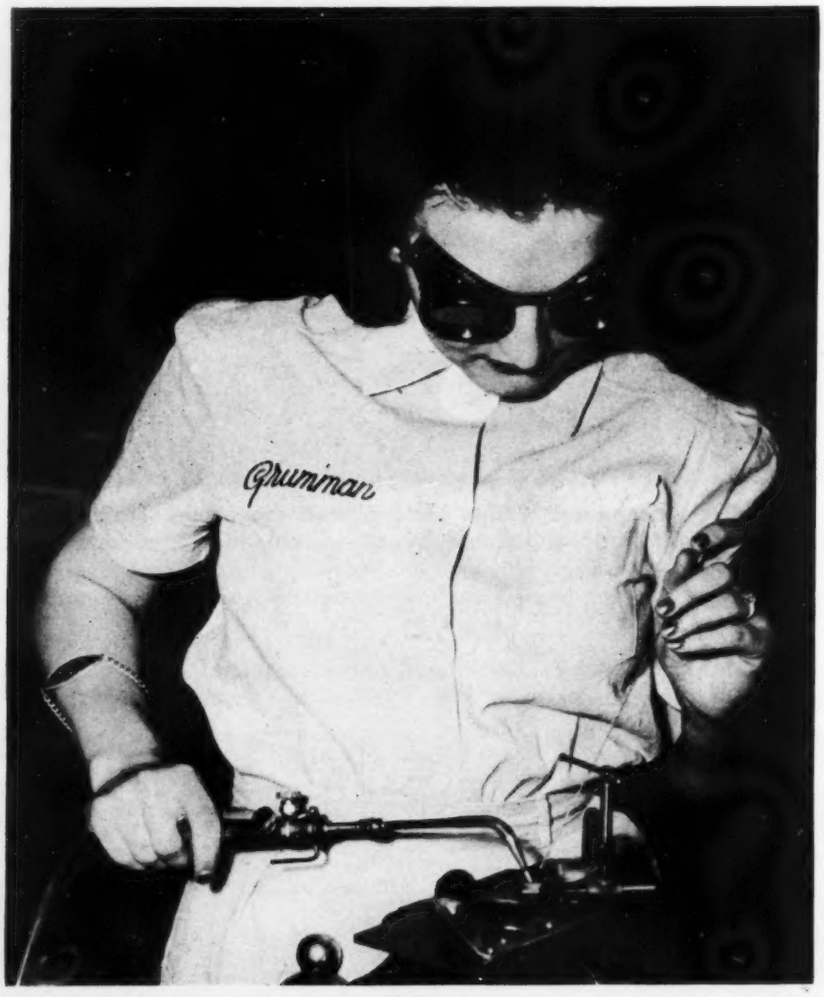
Can't get along without 'em, is consensus at Long Island bomber plant where number of girls on payroll has spiraled from none to 900 in six short months

PAUL S. GILBERT, Personnel Director, Grumman Aircraft Engineering Corporation
Bethpage, N. Y.

How about women? I am often asked that question these days. My best answer, I think, is to point to the 900 already at work in our plant, most of them on jobs we have always earmarked "for men only." At the moment we have a standing order for 200 more women a month. The welcome sign is on our front door mat—for women who live on Long Island.

All this has happened within the short space of five or six months. Had someone told us last spring that we would have upward of 1000 women in our plant before the snow flew, we'd have said it wasn't possible.

You see, our problem when it came to the hiring of women looked a lot different from that of most other plants. We are well out on Long Island, 40 or 50 miles from the big city and hence far removed from any considerable supply of experienced female help. There are few factories in this neighborhood, and they were not here a year ago. Thus we knew there were few women available who had previously worked in factories. Not that we could have hired and put them to work right away even if they had been available. It is nevertheless true that women who have worked before are, generally speaking, to be preferred to those without prior work experience.



Welding a job "for men only"? Not at Grumman. Girls there are taking it over fast. Dorothea Ritchie majored in it at training school. All welders stay on practice work and tacking jobs until they have passed the Navy test and can qualify for regular production work

Fresh From Training

Actually, because of our unusual tie-up with state and local employment and educational services, the dearth of women with earlier factory experience has been no great handicap. At any rate our women have no bad work habits that have to be unlearned. They come to us fresh from one or another of seven training schools in our vicinity. Two of the schools are full-time aviation schools run by the state. The other five are evening high schools in nearby communities. Right now nearly 700 women in these schools are being trained specifically for factory work at Grumman.

It works out like this for the woman who wants a job here. First she registers at the office of the New York State Employment Service in Nassau or Suffolk County. There she files an application for work at the Grumman plant and is told when to appear at one of the schools for a mechanical aptitude test.

Each girl who passes the test is then interviewed by a member of our employment department. If acceptable, she is told to go home and wait until there is a vacancy in the school. Girls seldom have to wait more than a few days. At the same time she is told that there will be a job for her when she has successfully completed.

Eileen McManus (above, left) has a boy friend in the Army. He's a sergeant, too, she adds proudly. Grumman finds women with men in the service are invariably high production scorers. Girls at right team with a smile on a rib subassembly that is going to be part of a torpedo bomber wing. Below, two girls on a sander didn't like the idea at first of wearing respirators, as what pretty girl would? One has a husband working in another department, which Grumman says is an ideal arrangement

the course. She is also warned that she will be dropped if, after the first two weeks, she has not made sufficient progress.

The full course comprises 400 hours of work and many more hours of study at home. It is divided into five periods of two weeks each, covering blueprints and layout, bend allowance, riveting, hammering, and assembly. As a result we get women who may never have seen the inside of a factory but who have been inhaling a near-factory atmosphere for ten weeks. They may never have to use some of the knowledge they have just acquired. No matter. They have learned "to talk the language." The shop is bound to be a strange place when they first come to work, but it is not nearly so strange as it would have been without this preliminary training.

We have found, incidentally, that the best women are (1) those accustomed to work—it may have been in a beauty parlor or a 10-cent store; (2) those who need to work; (3) those who have husbands or boy friends in the armed services. All must be physically able to work ten hours a day.

We do not want women who are

Riveting is another job that Grumman girls are beginning to look on as their very own. These two girls take turns shooting and bucking

Three girls feed hydraulic press. It's simple. They place parts on dies and insert rivets to hold parts in place while in the press

Women have the patience that goes to make good inspectors; here, 100 percent inspection of purchased parts, often to half a thousandth

merely out to earn a little pin money. We especially like women with men in the war; they feel that they, too, have a job to do and are among our best producers. Many of our women are wives of men in the plant. We encourage this arrangement but see to it that they are kept apart, for fairly obvious reasons.

Otherwise we make no effort to separate the women from the men. I do not suppose the time will ever come when a good-looking girl in well-tailored slacks will fail to attract some attention when she slips off for a drink of water or heads toward the restroom. But it is nothing more than a polite, natural interest of the eyebrow-raising type and is not characterized by catcalls or any other type of vocal demonstration. A man looks up from his work for a moment, maybe grins at his nearest male neighbor, perhaps murmurs, "Oh, boy," and is back at his work without missing a motion.

Placed Where Jobs Are

As for men working side by side with women, we have found that they are less distracted by the presence of the opposite sex than men in departments where there are no women at all. Our girls, as it happens, are more or less concentrated right now in a few departments, but as more and more opportunities open up for them they will be placed wherever the new jobs happen to be.

Foremen have been instructed to be on their guard against horseplay of any kind, but so far have had little or no trouble. Both men and women seem to feel that this is serious business they are engaged in, and both sexes seem to keep their minds mostly on what they are making.

We allow the same social intercourse between men and women that we would allow between people of the same sex. In short, we make it clear that they are all workers of exactly the same status. Possibly it is this very freedom that simplifies the problem. No doubt if we put up fences between the men and the women they would find some way of getting together. We certainly see no reason for being too paternalistic. We do not believe it is too much a part of our job to worry about the morals of the women we hire any more than it is to worry about the morals of our men. Our job, as we see it, is to make the plant a good place to work in and hire the kind of women we think can turn out the quality of work and amount of work so necessary in the current emergency.

To date most of our women are working on simple jobs of a repetitive nature. For many repetitive tasks involving small, light parts we find they do better work than men. They are more patient, for one thing, and possess greater finger dexterity. Since they do not know anything when they first come to work, they have to know the reason for everything. They are fussy and particular, hence make good inspectors on small parts.

For instance, we use girls in the inspection of machined parts that come in from outside suppliers. This is 100 percent inspection, and the girls have to be proficient in the use of micrometers, vernier calipers, double protractors, and stop gages. They often work to tolerances as tight as half a thousandth.

Here the visitor to our plant sees three women feeding a big hydraulic

(*Continued on page 228*)

One girl brings her own lunch. Another does nicely with a sandwich and a glass of milk. Number three prefers a hot lunch. There is room for all in the huge air-conditioned cafeteria at the Grumman plant

Helped Ourselves to War Work

WILLIAM FOGEL, President, Fogel Refrigerator Company, Philadelphia

WE ARE MANUFACTURERS of all types of commercial refrigerators for food markets, warehouses, hospitals, beer-dispensing establishments, and restaurants, and have enjoyed an increasing volume of business in this field. Over a year ago, however, we could foresee what effect preparation for war was going to have on an industry that uses so many critical materials.

For the past year we have been trying to educate our dealers and distributors into getting in touch with defense plants and governmental agencies to obtain priority business. This was a difficult task, and the results were not too favorable. Our sales organization was not accustomed to calling on this type of prospect. Most of their contacts were with retail food merchants, not industrial plants. Moreover, civilian business was better than ever, and it was hard to convince our men that they had to look ahead and prepare for a curtailment of civilian production.

We had designed a complete line of refrigerators for all military and industrial purposes, including prefabricated meat storage rooms, special refrigerators for Army camps, refrigerators for airplane factories, and custom-built refrigerators designed to maintain sub-zero temperatures. We also maintained a special department to fabricate refrigerators to unusual specifications. We kept emphasizing to our dealers that we had excellent woodworking and sheet-metal facilities to fabricate other products.

Separate Department

At the factory we created a separate government contract department. This department devotes all its time to making contacts and bidding on all types of war work. Letters were sent to every government procurement agency asking to be put on the mailing list for any type of sheet-metal, woodworking, or refrigeration items. From various publications the names of prime contractors were obtained and they also were solicited. In this way complete mail coverage was obtained, creating a flood of invitations to bid on various items. Where bids required local installation and servicing we sent many of them to our distributors.

At present the company is engaged in filling a large contract for refrigerators for many of the camps now being constructed for our growing Army. Refrigerators for use in gunpowder plants were also supplied by us to several of the government arsenals. We have furnished mortuary refrigerators, toolchests, mess-hall tables, and various other items made from sheet metal or wood. Our field organization is given complete stories on these products so that it may know about the various new items we are manufacturing.

When the War Production Board issued an order curtailing the sale and manufacture of commercial refrigerators, we were anticipating that such an order would come through and that news of it would have a depressing effect on our sales organization. In preparation we devised a campaign that we called the "Victory Offensive." This campaign was timed to go out the same day the order was issued. It was intended to divert salesmen's attention and keep them from worrying about what was to become of them, give them an incentive to go out and look for priority business instead. The awards were made liberal enough to give them this incentive.

This campaign has been in progress only a short time, but the results are gratifying. It has lifted the morale of the sales organization, and has given them the feeling that they are wanted and necessary, and not to be considered as stepchildren who are to be left to look out for themselves. We daily offer leads and advice with instructions to get the inquiries and send them in to the factory. We do the engineering and estimating.

"Gold" in the Scrap Pile

Reclamation is an integral part of the war program. Every bit of scrap is needed to make bombs and bullets, airplanes and boats. Here is a practical, down-to-earth article on how to handle such scrap so that it attains its full usefulness

RAY SCHMIDT, Supervisor, Reclamation and Salvage Department, Westinghouse Electric & Manufacturing Company, East Pittsburgh

WITH THE PRESENT vital need for wartime production materials, the lowly scrap pile is being scrutinized as it never was before. The rusting junk heap behind the plant has almost reached the precious-metal class and, in wartime, is even more important.

Reclamation and salvage are generally conceded to be a business at the Westinghouse Electric & Manufacturing Company, where $2,500,000 worth of salvaged materials were sold to outside consumers in 1941. For economic reasons, therefore, the subject merits considerable attention, but it is more important right now as reclamation is an integral part of the defense program.

Unfortunately, in the process of manufacturing, varying amounts of purchased materials necessarily become either inactive, obsolete, surplus, scrap, or waste. In considering the disposition of these "left-overs" certain fundamental facts must be kept in mind:

1. Can the material be used "as is" or with economical modifications for any purpose other than that for which it was originally purchased? For example: (a) Use the material for other material of the same grade and nearby sizes; (b) substitute excess material for a cheaper material and shear or strip sheet metal parts to obtain narrower and desired widths.

2. Can the material be reclaimed or modified for use by welding? Welding has become an important factor in making advantageous disposition of castings that are received with blowholes and other defects. This is also true of many fabricated parts that have become obsolete either through overstocking the part or discontinuing the product for which the part was designed.

3. Can short ends of bar stock or pipe be welded together to make a usable length? Frequently a substantial saving can be realized in this way, and lost productive time may sometimes be saved.

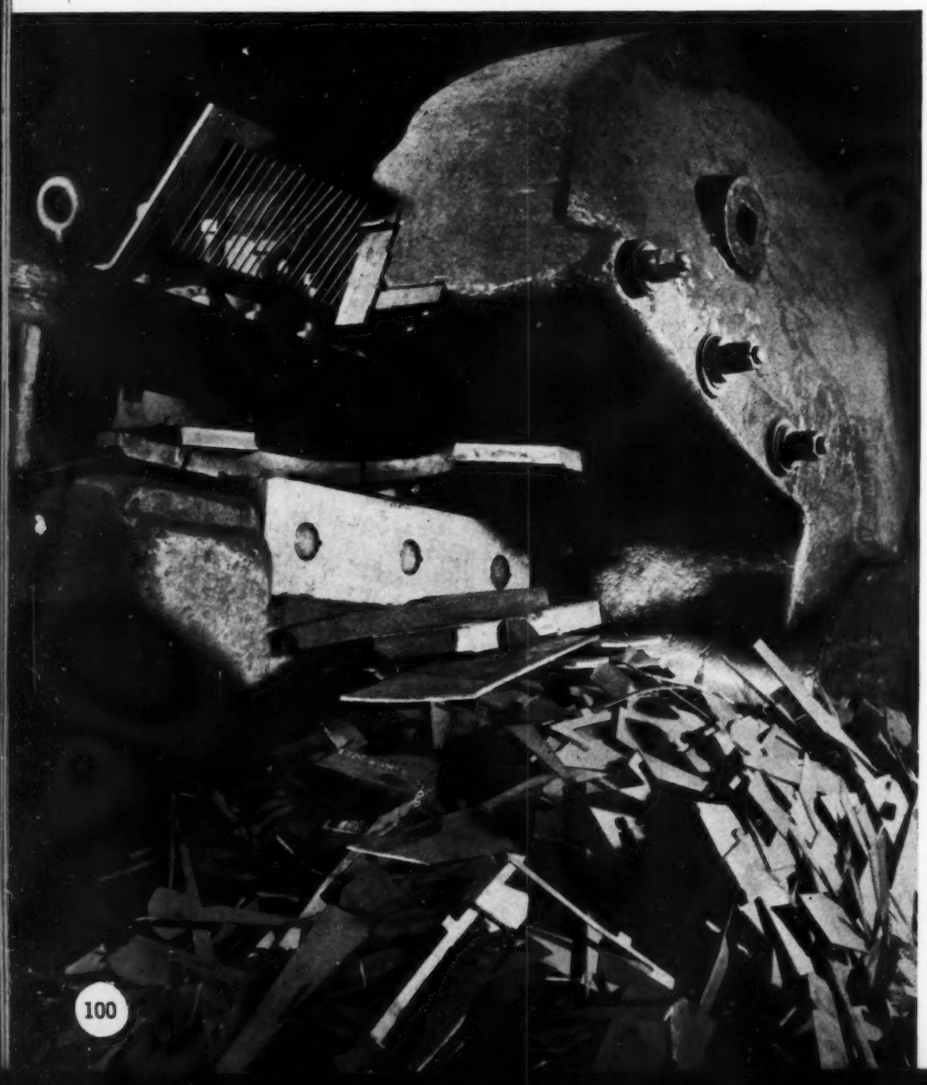
4. Can the material be returned to the source from which it came.

The importance of segregating scrap materials at their point of origin cannot be overemphasized, as any salvage supervisor will testify. A small piece of zinc thrown into a container of scrap aluminum will render the latter unfit for reclamation and subsequent use in airplane manufacture. Until science finds an economical way to separate aluminum from zinc, thousands of tons of aluminum will be lost for wartime needs, unless care is taken in preventing contamination at the source. Other examples of segregation are:

1. Copper, if not mixed, is converted into refinery shapes, after which it is rolled and drawn into copper wires and strap for use in motors, generators, transformers, etc.

2. Iron oxide, known as "splatter," is swept from floors in welding and torching departments, gathered in

Heavy plate scrap from machine tool and machine frame fabrication shops is sheared into pieces for charging into electric furnaces



special containers, and sold to steel makers or to firms manufacturing powder metals.

3. Wood boxes are used as containers or crating lumber.

4. Scrap rubber, until recently hard to dispose of to advantage, is now carefully collected, graded, and sold to rubber manufacturers.

5. Worn-out and obsolete high-grade cutting tools, segregated by size and type, can be ground down to smaller sizes or sold to jobbers, who find a ready market for them.

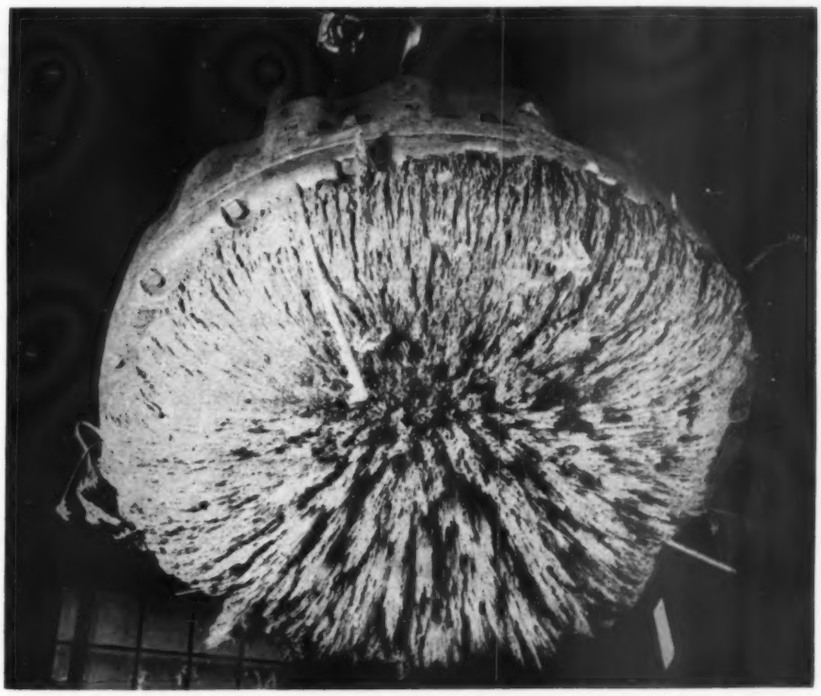
6. Babbitt cuttings for bearings, and tin and lead babbitts are kept separate and converted to ingots for re-use in our own shop.

7. Hardware, such as washers, bolts, nuts, screws, is kept separate when dismounting obsolete machines and parts, and returned to regular stock.

8. Cuttings from shafts of monel metal are kept separate and returned to original supplier for re-use. This item is 65 percent nickel.

Sheet molybdenum and tantalum look alike under normal incandescent

(*Continued on page 232*)



A 3-ton magnet operating from an overhead crane handles ferrous scrap first to the shears or torching floor and then into gondola cars for shipment or to temporary storage for later use

Wiping rags can be laundered and used again. Metal containers help to teach workers to return them

To avoid contaminating other valuable scrap, tailings are swept up and disposed of after each job

Crane-Conveyor Team Keeps Castings on the Move

No more backbreaking labor since handling equipment has been coordinated into a smooth-flowing system that makes productive operators out of weight lifters

CHARLES B. GORDY, Detroit Editor, *Factory*

CRANES AND HOISTS have been coordinated with roller conveyors to eliminate manual handling in the new cleaning building at Monroe Steel Castings Company, Monroe, Mich. This is especially noticeable at the two points in foundry operations where heavy lifting usually occurs—the mold and pouring floors, and the cleaning room.

Larger castings, those not handled on bumpers, are serviced by crane for metal pouring, as they always were. They are moved on a single roller conveyor pointed towards the transfer track to shake-out. It is in the movement of the smaller molds, roughly from 75 to 150 pounds, that coordination of materials handling methods has resulted in the elimination of heavy weight lifting.

In each mold bay there are two rows of narrow roller conveyors 15 inches above the floor. A board supported by cleats spans the space between the conveyors, upon which the molders place the completed molds. An air hoist moves the mold from the jolt machine to the roller conveyors. At this point heavy lifting has been completely eliminated and the productive life of operators consequently lengthened.

More Labor Saving

At the opposite end of the mold bays, at the pouring point, another backbreaking job has been eliminated. Molten metal is transferred from a large ladle to a small one operated by hand on light H tracks suspended from the building superstructure. The boards that carry the molds along the roller conveyors move to the pouring point. When they are in proper position under the ladle track, pouring is accomplished by manipulating the adjustment wheel on the movable ladle. The track that carries the small ladle is a loop beginning and ending at the end of the mold bay where metal is transferred from the large ladle. At this point, too, heavy labor has been reduced to light work.

At this point in the process materials handling equipment is effective in getting the castings from the pouring and cooling point to shake-out. In many large plants, making a small diversity of parts and with large floor space, this operation may be handled by a cooling conveyor running between pouring and shake-out. Space limitations, and the size and diversity of the castings made, prevented this solution at Monroe. It would not be economical, and yet weight lifting on the part of operators was not to be tolerated.

This movement from pour point and cooling to shake-out is handled by the same electric transfer car that supplies the pour-off men with metal at the end of the mold bays. Attached to the electric car as a trailer is a section of roller conveyor of just the height to snatch the rollers in the mold bays. The cooled castings, still in the molds, are pushed on to this car and moved by it to the shake-out frame immediately adjacent to the travel of the car. This transfer car is a busy piece of materials handling equipment. It moves through approximately the center of the plant, engaged in supplying metal to the pouring ladles, and in removing cooled, poured molds to the shake-out.

Usually cleaning, grinding, and chipping castings mean much hand moving of material—and heavy lifting. But here again as at the mold bays, coordination of materials handling equipment has eliminated backbreaking toil. Two paths of flow are provided at

Molten metal is transferred from a large ladle to a small one operated by hand on tracks suspended from the building superstructure

this point—the small castings, up to 50 pounds, are handled in a specially designed unit; and the larger castings, up to 600 pounds, are handled by methods appropriate to their weight.

From the shake-out point, prong trucks move the smaller castings in large metal buckets to the cleaning unit. The old method was to move parts not handled by the crane by wheelbarrow or by hand. Since the new method has been in use, there is a marked difference in the appearance of the floor. It is clear, and all work is handled on roller conveyors at waist level. Handling methods are synchronized with operations.

Parts are delivered in a totepan from sandblasting to the gate burner stands, and are shunted on to the roller conveyor which leads to the grinding and chipping stands. Swinging sections of conveyor shunt loaded totepans from the straight section to the short sections that serve the individual grinding and chipping positions.

Travel by Crane

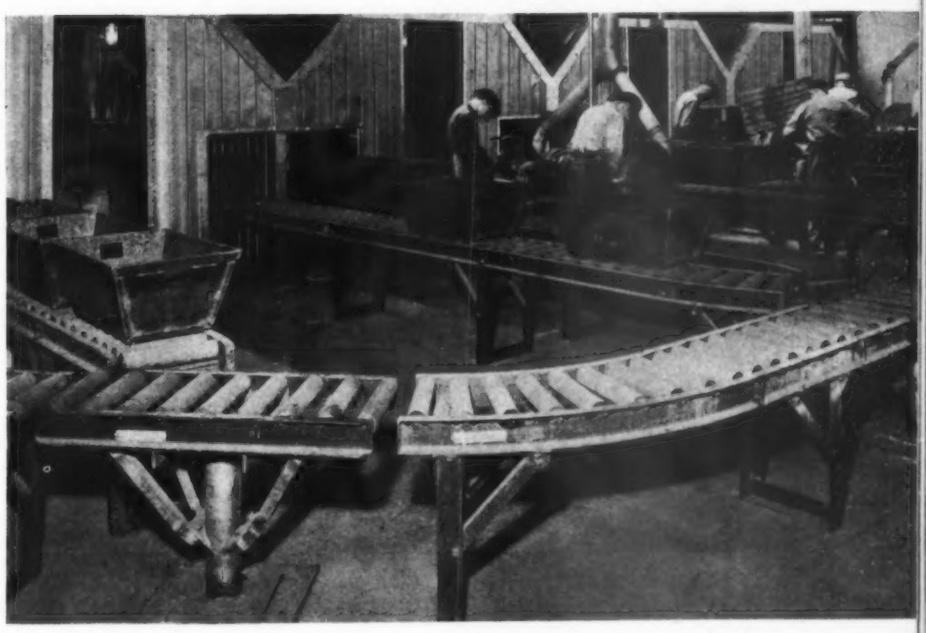
After chipping, castings move to the straight section of conveyor beyond the chipping booths. Here totepans are dumped into convenient buckets and castings moved by overhead crane to the annealing oven, inspection, and straightening presses.

If the chipper finds that welding is necessary, the totepan containing parts to be welded is shunted down the straight section of roller conveyor to the welding booth and then returned through the grinders and chippers to the point where the castings are dumped for crane conveyance to the annealing ovens. This is a regular "irregularity" in the flow of material in the cleaning of castings and is handled without confusion, backtracking, or lifting by the operators.

A duct system connects the chipping hoods in the booths with an outside means by which the dust count is kept to 6.2 million particles per cubic foot, although the permissible limit is 20. The chipper removes parts from the roller-moved totepan at waist level and replaces the completed part in another pan, also at waist level—no fatiguing trunk movement from and to pans on the floor.

Heavy castings, above 50 pounds, are handled on the same principle—progressive movement with no heavy lifting by the operators—but individually instead of in totepans. They are hung on an oval conveyor running through a shot-blast room. From this point they move by roller conveyor past the swing grinder booths where overhead hoists carry them to and from the grinding stands. The roller conveyor runs by one end of a series of four large chipping booths. An individual hoist enables the chipper to remove each casting as needed from the roller to his chipping stand, and from the latter to the roller conveyor at the front of the booths. From here the parts move to a point adjacent to the completion point of the small castings. Both are located on a craneway that services the annealing ovens and the inspection and straightening points, which are located near the shipping point.

Perhaps enough has been said to indicate that at no point in the sequential flow of material in this plant is the worker required to lift heavy pieces. While this is expected in quantity production with small diversity,



Swinging sections of conveyor are used to shunt loaded tote pans coming from burner stands to straight sections that serve grinders

Overhead hoists move heavy castings from roller conveyor to swing grinders. Thus another backbreaking operation is eliminated

it should be realized that the plant we are discussing is a jobbing plant with a wide diversity of work, and with a wide range in weight per piece.

It might be expected that we should close with a statement of such and such a percentage of reduced costs brought about by this system of coordinated materials handling devices. About the time this installation was completed, however, demands of war work began to increase, and have continued to the point where virtually the entire output falls into this category. Since the inspection requirements on this work are much more stringent than on normal peacetime production, any comparison with old costs would be meaningless. It can be stated, however, that the volume of shipments now made week by week would be impossible without the sequential flow of conveyor-handled parts. It is found, also, that the more orderly methods of handling material have resulted in more precise statements of the costs of such activities.

At the time that the layout of building and equipment was completed and the materials handling methods were perfected, it was decided to reduce the noise usually found in chipping and cleaning rooms. Noise tests under the old arrangement indicated a sound level of from 110 to 120 decibels. With the installation of acoustical booths the level of noise just outside now varies from 90 to 92 decibels —a material reduction. The state hygiene department recommends the use of protective ear equipment above 90 decibels. While no figures are available about the reduction in costs as a result of these acoustical booths, it is realized that maximum effort is not possible in unusually noisy conditions. After getting accustomed to working in these booths, chippers and others who work near them express themselves as considering the new conditions a great deal better than the old.

The construction of these booths is of interest. Walls are made of inner and outer steel panel sections bolted to an angle-iron frame. The panels and the deadener inserted between the outer and inner shells were, as a result of special studies, designed by Edwin S. Carman, Inc., foundry engineers and consultants, of Cleveland, especially to suit the conditions in this plant. The entire plant and methods were also developed by them.

The foundations of heavy equipment, such as grinding wheels and tumbling barrels, are insulated from the regular floor so that vibration is not amplified by transmission to building structural members. The noise that strikes the ear, therefore, is from contact of the chipping tool with the casting in the booth, and this, as indicated by the decibel test, has been greatly modulated and is no longer considered a hazard to the worker.

Our Nurses Go Looking for Trouble

Far more prevention—and consequently less cure—is the result of the nurses' daily trips through the plants. First air cases have increased 100 percent

JOSEPH E. MOODY, Plant Manager, Hodshon-Berg Division, Hat Corporation of America, South Norwalk, Conn.

WE HAVE ALWAYS had first aid nurses in our plants. Usually they found time enough to keep up with their knitting between calls for services.

Now we have promoted the nurses to the rank of staff officers—equal to department heads. Their responsibility extends beyond the hospital rooms into the plant, where they now make a daily inspection trip.

In this way each nurse becomes personally acquainted with the men and women in the shop. She also finds out about the toilet facilities and the cleanliness of all departments. She talks to employees concerning their health. This has boosted our first aid cases 100 percent. Our explanation is that the story of Mahomet and the mountain still works—whereas it is difficult to get the employees to go to the first aid nurse for minor ills and injuries, they will seek her advice when she visits them—and, having become acquainted with her, will go to see her when they should.

An example of how this has worked: In one department a dermatitis condition existed that we might have been a long time in discovering if we had waited until someone made a report to the first aid room. The first man who mentioned that he had a itch on his leg thought it was something that he got at home, and paid no attention to it. By questioning each member of the department, we found that it was prevalent. We took steps to correct the condition that we believe caused it, and now have it under control.

In another instance a nurse found two cases of chickenpox in a department, just through observation. She was able to take care of a situation that might well have developed into an epidemic.

It is easy enough to get broken legs and cut hands into the first aid room, but we believe that the nurse is a health officer, and should be in a position to make recommendations that will eliminate loss of time and production—and this her daily visits into the plant enable her to do.

Plant nurse Mary Shaughnessy has no time for knitting since she makes daily trips through the plant under her jurisdiction

Significant Labor Developments

Period surveyed: June 10 to August 10

TREND INDICATORS

Belo Doctrine Limited

IN THE SHORT TIME that has elapsed since the Belo decision (FACTORY, July, '42) several attempts have been made to pare down its effects. The only successful venture was Mid-continent Pipeline Company vs. Hargrave in which a Circuit Court of Appeals held that the benefits of the Belo case cannot be claimed by an employer unless there is an agreement between him and his employees that part of the wages paid should be allocated to or treated as overtime compensation. In other words, the agreement involved in the Belo case provided for basic pay and overtime pay, and thus was not a substandard arrangement such as the Wage-Hour Law sought to correct. (Incidentally, the Supreme Court will probably reconsider the Belo case in the October term, which is not surprising in view of the complete upset to the Wage-Hour Act brought about by its first decision.)

Contract to Pay for Only Part Time Held Invalid

You cannot claim an employee's time and compensate him for only part of it. Employees engaged to do both manual labor and act as watchmen were, therefore, entitled to claim back wages for all the time they were required to remain on the premises as watchmen. A contract which requires the employer to pay for only part of the hours an employee works is invalid. (Johnson vs. Dierks Lumber and Coal Company.)

Statute Not to Be Waived

Government agencies may not waive a penalty for violation of a law. This applies to the War Department generally as well as to others. In one case a penalty was assessed at $5 a day for each mechanic or laborer employed more than eight hours a day without being compensated for the overtime at time and one-half. This penalty for violation of the Federal Eight-Hour Law, ruled the Comptroller General, is mandatory, except in certain unusual circumstances, and it is deducted from the amount owed to the contractor by the government.

Interstate Wage Records Must Be Segregated

Generally employees who do both intrastate and interstate work have the burden of proving that they have done interstate work if they are to recover under the Wage-Hour law. The Kentucky Court, however, refused to apply this rule where the employer himself failed to segregate the interstate and intrastate work, and the products the employee worked on went both into intrastate and interstate commerce. (Gaskin vs. Ciell Coleman & Sons.)

No Injunction Against Possible Future Violations

Where employers have fully complied with the Wage-Hour Act, the District Court refused to enjoin them against future violations on the ground that such an injunction was unnecessary. In one case (Walling vs. Shenandoah Dives Mining Company), the employer contracted for standards higher than those required by law. In the other (Walling vs. Pine) the employees had been paid for overtime.

WAR LABOR BOARD

** WLB Takes Jurisdiction of Non-War Dispute*

Consistent with its original pronouncements, WLB now emphatically asserts its jurisdiction over any labor dispute irrespective of its relationship to or concern with war production. The justification for its position the Board finds in the likelihood of serious repercussions in war industries, or in the labor movement generally, were it not to assume jurisdiction. This latest ruling of the War Labor Board brings under its authority practically all large business, for somewhere along the line labor disputes in any such business may have repercussions in a war industry. (Montgomery Ward & Company.)

WLB Sustains Employer's Control Over Job

Management as well as the war effort scored a decisive victory when an arbitrator for the WLB denied the right of a union to assume charge of the work of installing telephone cable at an air field. Since the task is one which directly concerns the national welfare, ruled the arbitrator, the decision of the Army and Navy officials who let the contracts should control.

** WLB Defers to NLRB*

The War Labor Board refused to decide whether employees were discharged in violation of the Wagner Act. Problems such as these, the WLB ruled, should be decided under the grievance procedure provided for by the collective bargaining contract or by the NRLB. (Thermoid Co.)

Negotiations on Company-Wide Basis

The War Labor Board ordered negotiations to be undertaken on a company-wide basis when all the plants (five in number) are represented by locals of the same union. The mere fact that the NLRB had certified union locals at individual plants as bargaining agents was held to be immaterial. (Wilson & Company.)

** Management Urged To Organize*

Chairman William H. Davis recommends that employer groups organize to promote an equality of bargaining power between management and labor. "It makes for greater stability throughout an industry, more responsible unions, and puts management on a more fair and equitable basis so far as wage costs are concerned," said Mr. Davis.

No Freezing of Jobs Yet

Until a plan is evolved for wage equalization for comparable work, employees will not be barred from changing their place of employment for higher wages, the WLB ruled. This ruling was necessitated by a practice of management not to accept as an employee a person who had left a job with another of the employers for the sake of obtaining higher pay. (Fairchild Engine & Airplane Corporation.)

(*Continued on page 238*)

* In this and the following classification items marked with an asterisk also are considered to be trend indicators.

Where

How ONE plant is conserving rubber, how other plants can save this vital material, is illustrated in the experience of RCA Manufacturing Company with a new synthetic resin. Today this material is supplanting rubber and synthetic rubber in fifteen different applications. And in nearly every case the substitute is outwearing and outperforming the original material.

A typical substitution is in flexible gas-air lines. In the manufacture of radio tubes a great number of processes involve the use of gas fires. Since the burners of the machines are frequently in motion and always adjustable, a flexible connecting medium is required to convey the gases from the fixed manifolds to the movable burner piping. Time-honored custom had made rubber tubing standard for this purpose because of its ready availability, relatively low cost, and ease of installation.

Similarly, the connectors between

(*Continued on page* 248)

1 Biggest rubber saving is in gas and air line connectors on tube-building machines. This hose has plastic core, braided cotton jacket; stands up under many months of hard use

2 Resistance to abrasion and wear makes plastic wrist protectors in sandblast machine outlast rubber predecessors

3 Jaws of forming presses for small parts are lined with plastic cemented directly to the metal. This one application has resulted in big saving for RCA

4 Ball mill gaskets cut from polyvinyl-alcohol plastic material resists chemicals better than rubber and synthetic rubber gaskets formerly used

5 Another application where rubber is being replaced by this semi-plastic compound is in transmission rings that rotate against metal gears to supply power for various operations

6 Operator shows how plastic hose is used on suction line of sandblast machine. Hose has been in service three months. Rubber hose had to be replaced weekly, sometimes oftener

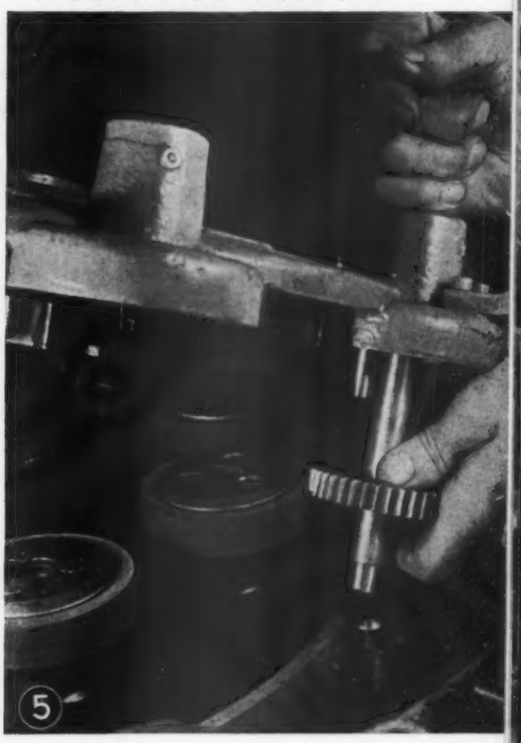
7 Small parts cannot stick to or get caught in the plastic conveyor belt that has now replaced one made of woven wire

8 Three weeks is the life of a plastic aligning ring used in clinching metal parts. Rubber ring was good for a few hours

Plastic Replaces Rubber

Synthetic resin compounds outlast, outperform scarcer material in fifteen widely varied applications at RCA. Eight shown here suggest uses in other industries

Photographs by courtesy of Resistoflex Corporation



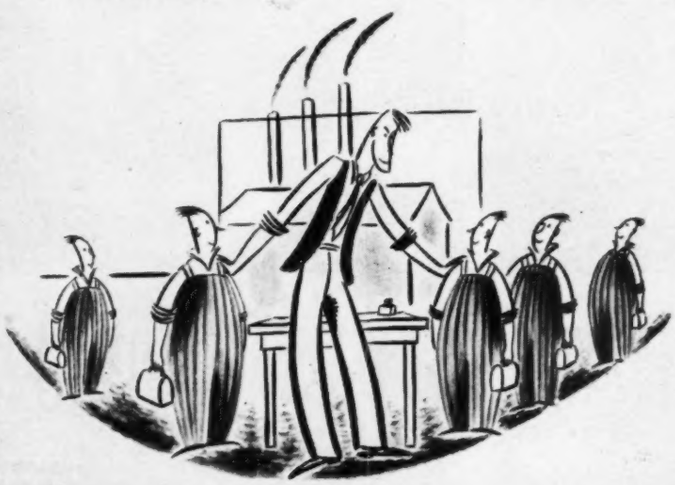
The Code of a Good Foreman

CHARLES REITELL, Stevenson, Jordan & Harrison, Inc., New York

Illustrations by Elizabeth Reitell

A Good Foreman:

1 Realizes that he is an executive of the company and, as such, accepts full responsibility for the safety, welfare, and success of those under his supervision



2 Understands that first and foremost he is a teacher and is, therefore, responsible for training the workers so that they may develop correct work habits, exact skills, and fine shop spirit

3 Knows that waste – waste of time, tools, and materials – is the archenemy of efficient production and stops this deadly enemy at every turn

4 Knows that fine housekeeping sets the standards for quality workmanship – therefore, cleanliness, orderliness, and planned effort are ever a part of his daily work

5 Appreciates that he is a strong link in an important chain of department heads working together in the vital task of maximum output in minimum time – thus cooperation is his guiding motive

8 Realizes that the worker to be a successful employee must feel right about his job, his boss, and his company. Thus the bawling-out and belittling of workers are taboo. In their place are found fair treatment, a sense of security, and good will

6 Finds that costs are the measure of plant performance and is alert to see that his costs are under constant control

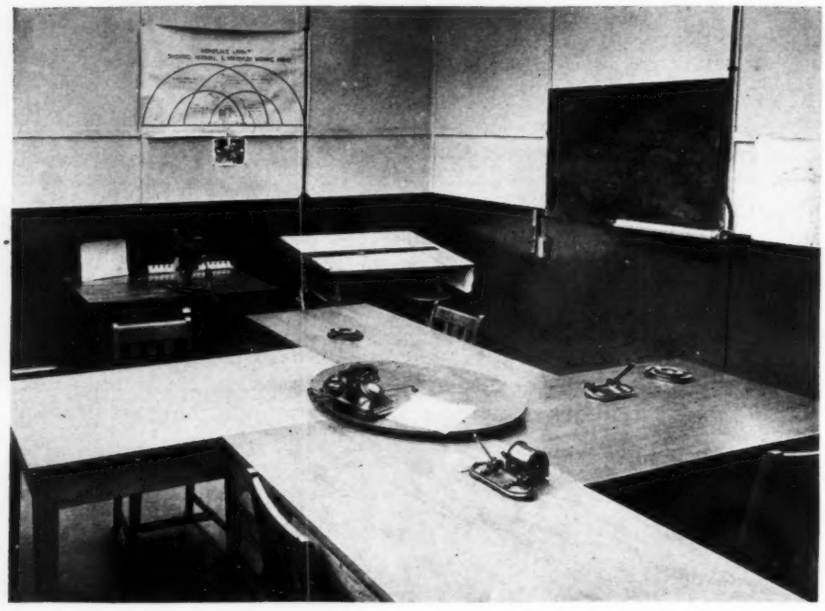
9 Replaces prejudice and narrowness with understanding and open-mindedness in dealing with the efforts of the workers in collective bargaining and thereby achieves greater harmony and less conflict

7 Regards complaints of the workers as frank criticism of operating and plant conditions and avoids cancerous grievances and ugly grudges by acting promptly on all complaints

10 Believes with a religious fervor in the spirit of American democracy – a democracy that vitalizes his effort and the effort of every worker under him

MANAGEMENT SHORTS

Readers are invited to contribute brief articles, illustrated when possible, reporting out-of-the-ordinary management accomplishments. Accepted articles will be paid for



Methods engineers speed own work with blackboard and telephone turntable

Two Time-Savers for Plant Offices

A. W. BUCKLAND, Motion Study Engineer, British Thomson-Houston Company, Ltd., Rugby, England

How many persons pick up the telephone receiver in the right hand and then have to change it over in order to write or to turn up a reference? The arrangement shown in the photograph shows how we have arranged four desks to insure that each man will pick up the telephone with his left hand and thus have his right hand free.

The telephone is mounted on a simple turntable constructed as follows: A circular piece of plywood has been mounted on ball casters which travel on a circular runway. The board is recessed to take the feet of the telephone in order to prevent its slipping off, and the runway is mounted on a short square post which fits into a space between the desks and serves to locate the turntable. The telephone wire runs through the center of the turntable and down the middle of the post.

Another idea which has proved its worth in this office is the blackboard seen on the wall at the right. In any office where ideas have to be developed, the speed with which one can work with chalk and blackboard has a stimulating effect not to be experienced with pencil and paper. And the basic idea, once developed, may be left on the board while it is being translated into a working drawing.

It will be noticed that the board cleaner is suspended on a string at the left-hand side of the board, where it is at once prepositioned the moment it is released after use. No need to put it down carefully and no need to search for it.

Conveyors at Scale Cut Errors and Time

DANIEL BERG, Bridgeport, Conn.

We were throwing away money at our scales. Several of our good customers wrote and told us that they had received more weight than they had been billed for. Naturally, we also had letters from others, telling us that they had been overcharged.

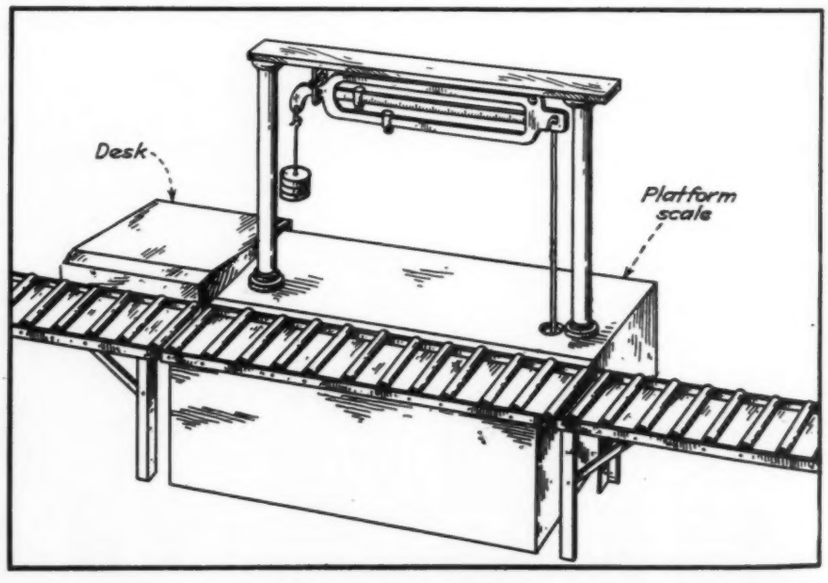
The president of our company receives a copy of every serious, legitimate complaint from customers. To him, it seemed like pure carelessness, but we who were closer to the situation decided to make a very careful investigation, and hoped for a permanent cure.

We found that the procedure at the scales was for one or two men to carry the box from the place it had been packed, to the scales, where it was weighed. Then the box was lifted to the floor while the weigher made out a packing list to be placed in the box. The box was then lifted again to a place where the top boards could be nailed on, and the box was properly marked for shipment. Again it was picked up, and put in a place where it could be shipped out.

This procedure made a constant congestion of men and materials around the scale, and, there was just about as much work in getting out of each other's way as there was production.

We permanently fastened a length of roller conveyor across the platform of the

(*Continued on page 254*)



MAINTENANCE SERVICES

SELECTION • INSTALLATION • INSPECTION • UPKEEP • ORGANIZATION

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CHANGE OF ADDRESS

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MAINTENANCE as the Editors See It

Get Ready for Snow Before It Falls

MUCH OF INDUSTRY may be compelled within the next few months to fight an enemy that can easily almost paralyze a big city or bog down an army. That enemy is snow.

Prompt removal of snow from highways as well as plant roads is important to industry at any time. Even a comparatively light fall can interfere so seriously with traffic and the movement of materials that production in a great many plants in the area affected may be badly hampered, or stopped altogether. In normal times such loss of production is not a serious matter. If necessary it can be made up by overtime work.

Not so today. Every hour of production lost means that much loss of war material that is badly needed by our country and our allies. During the coming months snow could easily work for Hitler more effectively than a submarine load of saboteurs.

Adequate provision for snow removal is, of course, the answer to this menace. It is up to every industrial plant to see that it is prepared to keep its roads, approaches, and parking lots open. The next step, equally important and also to be taken long before snow falls, is to impress on municipal, county, and state authorities the importance of having on hand enough snow removal equipment to keep traffic moving freely on all street and highways.

Today the cost of war material production lost through avoidable delays must be measured in lives that might have been saved, or battles that might have been won, rather than in dollars and cents. The cost of preventing such delays, whether due to snow-blocked roads or anything else, is trifling compared to the cost of failure to prevent them.

No Need to Be in the Dark When Lights Go Out

A POWER LINE FAILS, or the blackout signal sounds, and all lights go out, but workers in the plant are not plunged into chaotic darkness. Portions of the wall glow with a soft greenish light. Similarly glowing direction and exit signs permit workers to find their way around, help to avert a panic. Electric switches, fire extinguishers, control valves, hazardous places are likewise distinguished. No one is injured. Key workers easily find any control or equipment.

A fanciful preview of what may take place in some plant 50 years or so hence? Not at all. These conditions can be duplicated in any plant today. Luminous paints are the answer.

Substances that glow in the dark are not a new development. They have long been known, and have found some use. Wartime has, however, focused attention on the usefulness of luminous paints, and recent development work has enhanced it.

Ordinary luminous paints contain pigments that have in effect the property of soaking up a large quantity of light and releasing it slowly. They may continue to glow for a considerable number of hours. When the glow ceases their pigments will be recharged when exposed to bright light. The whole cycle of charge and discharge is as automatic as day and night.

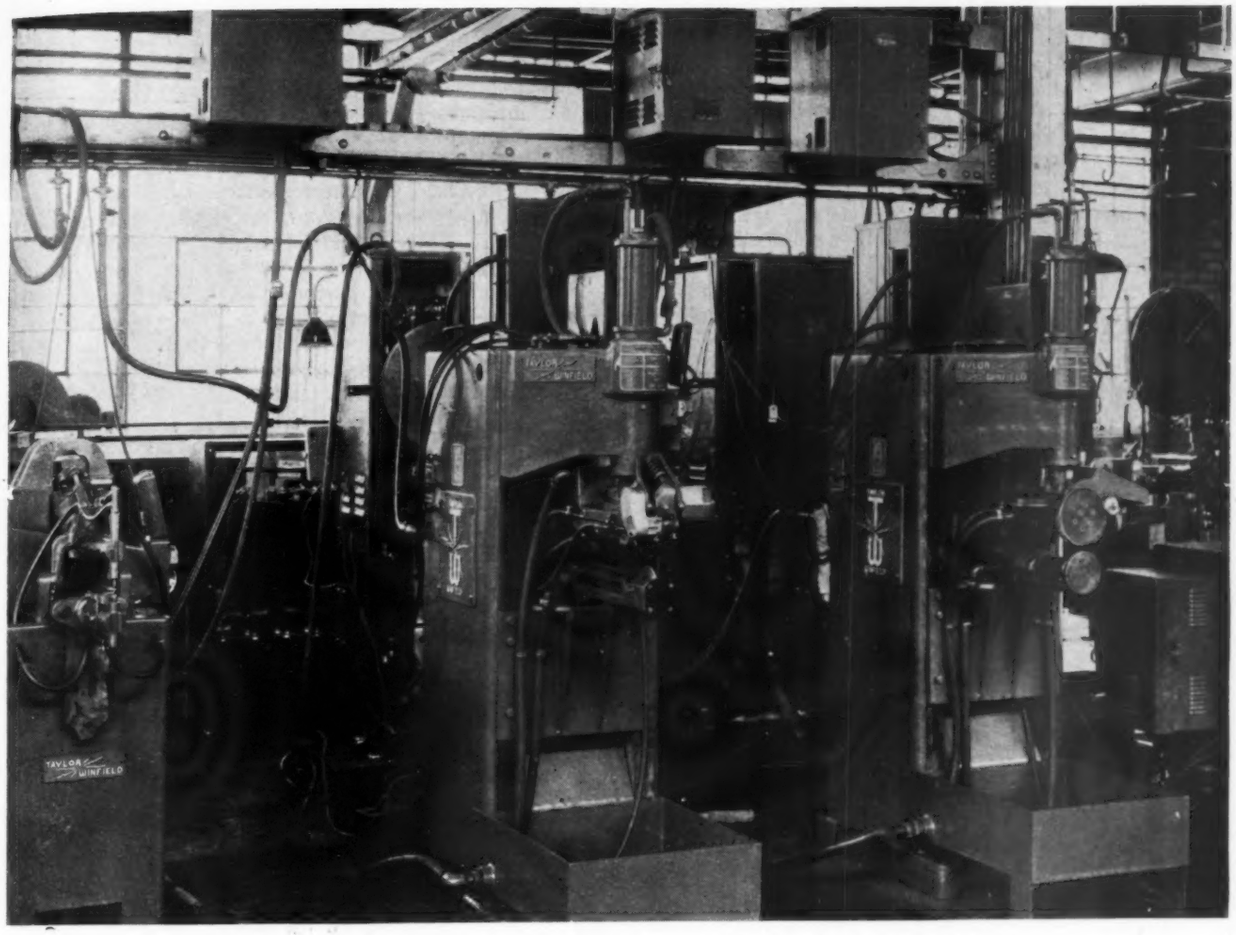
Luminous paints present enough interesting possibilities for service, both in wartime and peace, to make them well worth investigation.

Look for Hidden Corrosion Before Painting

WHEN A SMOKESTACK in a midwestern plant collapsed during a recent storm, plant officials were both surprised and mystified. The stack had been painted regularly. It looked all right from the outside. Then it was found that corrosion from the inside had eaten away most of the metal. Hammer-testing once a year would have disclosed the corrosion in time to make repairs, or at least prevent a collapse.

Smokestacks are not the only steel structures from which hidden corrosion can exact a heavy toll. On water tanks and trestles—in fact in almost any steel structures—there are often pockets or crevices where water can collect and keep corrosion active most of the time. The proper kind of paint will do a well-nigh perfect job of protecting all surfaces to which it is applied, but it is not always forced into places that should be protected. The result is that while exterior surfaces are well painted and appear to be in good condition, serious corrosion and weakening of some structural parts may take place quite unexpectedly behind the scenes.

A careful inspection to uncover corrosion in all places in structural steelwork where water may penetrate or collect may prevent serious trouble. Such an inspection certainly should be made by a competent engineer before any painting is done and often enough to make sure that steelwork is as sound as it looks.



Series capacitors on battery of welding machines solve load problems

What Capacitor for Welders

Welders often create low power factor and voltage drop; shunt or series capacitors provide the cure

R. E. MARBURY, Capacitor Engineer, Westinghouse Electric & Manufacturing Company, East Pittsburgh

SHUNT CAPACITORS are generally used to improve power factor, to reduce billings for electric service, to improve operating conditions within the plant, to reduce line losses, or to improve voltage at the terminals of the machines.

Welders must be considered in a power factor analysis because they constitute an additional low-power-factor load, or because they cause "bumps" or voltage dips in the line.

An arc or resistance welder on which the welding operation lasts for seconds may be considered the same as any other piece of equipment having a low power factor that can be improved with a shunt capacitor. To calculate the kva. of capacitors required to increase power factor to the desired value, it is necessary only to determine the kilowatts drawn by the welder and the power factor during the welding period. If several welders are used simultaneously, it may be desirable to put sufficient capacitors on the circuits to take care of the average condition rather than to equip each welder with a capacitor; otherwise the total installed kva. of capacitors would be greater than necessary.

If the welder is of resistance type, drawing welding current for only a few cycles (often true of spot welders), the welder load consists of a large number of short periods in which current is drawn, plus long periods during which no current is drawn. This means that the welder load is made up of many high momentary loads rather than long periods of continuous operation.

When the welder starts to make a weld there is a large inrush of current, largely reactive kva. followed by several cycles during which the welder

draws a lower kva. Total energy required to make the weld must be put into the weld during a short period.

A shunt capacitor connected to a resistance welder has little effect in reducing the momentary kva. inrush drawn by the welder each time it starts to make a weld; consequently, shunt capacitors do not appreciably reduce dips in line voltage caused by this sudden inrush. After the welder has been in operation for one or two cycles, the capacitor acts the same as it would with a motor and reduces the continuous current taken from the line by supplying the reactive kva. to the welder, but in most spot welders the welding operation is over before this condition becomes significant.

From these facts it is obvious that a shunt capacitor cannot be effectively used on resistance welders to eliminate the initial inrush drawn from the circuit. Without going into a technical discussion of the problem, it can be pointed out that if a capacitor, with a reactance canceling the welder transformer reactance, is placed in series with a resistance welder, the entire combination can then be connected to the line without causing the large inrush that accompanies the conventional installation. The voltage required to operate a welder and series capacitor combination is the vector sum of the voltage across the welder and the voltage across the series capacitor; this resultant voltage is much lower than that required by the welder itself.

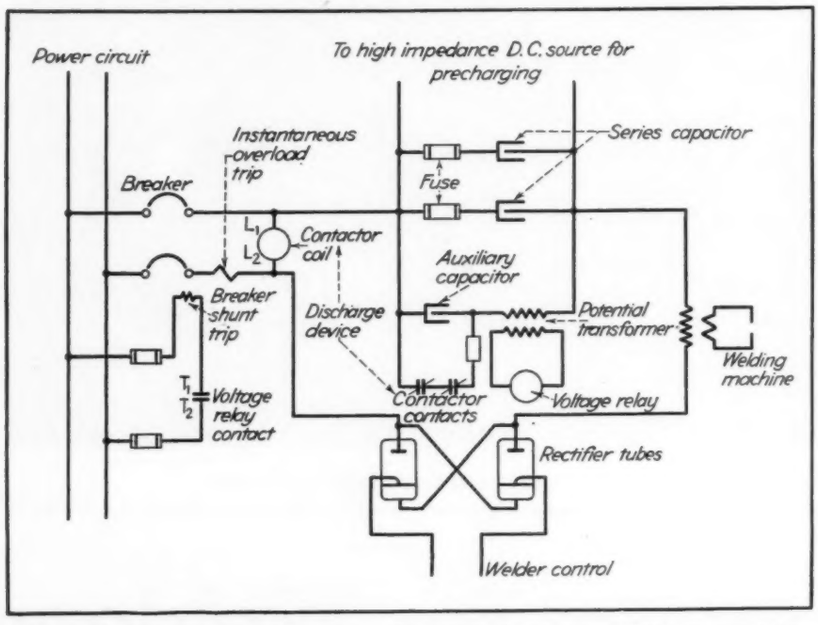
If the complete combination is still to be operated at the same line voltage as before, the welding machine must be rewound for a higher voltage, or, as an alternative, an autotransformer may be used to step down the supply voltage to the required lower supply voltage. Usually rewinding the welding transformer proves to be more economical.

A shunt capacitor can be used for correcting the steady-state power factor but not for eliminating the momentary current inrush taken from the circuit. If voltage dips are to be substantially reduced, it is necessary to resort to the use of a series capacitor. A series capacitor cannot be applied in the same simple manner as a shunt capacitor, because of the necessity for rewinding the welding transformer or changing the supply voltage, and because of the effect upon the electronic control accessories.

Determination of the size of a series capacitor for a resistance welder takes into account the designs and characteristics of the welder transformer. Either calculated or test data on the operation of the welder, such as kilowatts drawn during welds, power factor during welds, also power factor and kilowatts drawn when welding-machine electrodes are short-circuited, may be required. If the welding machine has an adjustable throat setting, it is necessary to obtain data with the largest throat setting. Obviously, the combination of a series capacitor and resistance welder must operate as a unit; each welding machine must be fitted with its own series capacitor.

The series capacitor should be considered when special limitations are imposed by the utility, such as extra charges due to momentary demand peaks, limitations as to the use of resistance welders, size of welders, or periods during which they can be used. Where the power rate is worked out in such a way as to account for instantaneous kva. demand, as well as 15-min. kva. demand, the series capacitor produces a greater saving. The series capacitor makes it possible to operate larger welders than were previously possible on a given circuit, or to operate a welder during periods of the day where the use of the welding machine was heretofore restricted.

Shunt capacitors may be effectively applied to groups of resistance welders where the purpose is primarily to correct power factor more than to eliminate voltage dips, and where there are so many welders that the over-all load condition is sufficiently steady to affect the reading of a 15-min. kva. demand meter.



Wiring diagram shows how a series capacitor is applied to a welder

When Lamps Flicker

Series capacitors are not applicable to flash welders, since the resistance component varies over a wide range, and it is not usually practical to cancel out all the welder reactance. Where flash welders are responsible for lamp flicker, it is often possible to install a series capacitor on the power line serving the plant for the purpose of canceling some or all line reactance.

Summarizing the above, the following conclusions can be reached:

1. Shunt capacitors can be used with arc welders to raise steady-state power factor.

2. Shunt capacitors can be used with resistance or flash welders if steady-state power factor or removal of thermal overloads in line transformers and generators is of major importance.

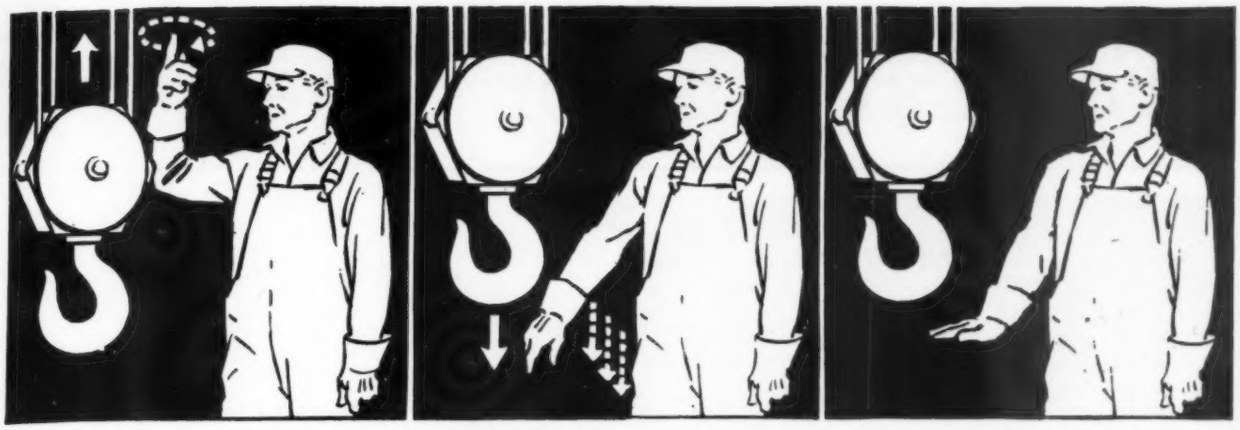
3. Shunt capacitors should not be used where reduction of voltage dips is important.

4. Series capacitors reduce the inrush or instantaneous kva. drawn by resistance welders.

5. Series capacitors are not satisfactory for use with flash welders or welders that operate with widely varying resistance components.

6. Series capacitors can be used to cancel circuit reactance.

7. Series capacitors are not usually economical when the circuit voltage at the point where the capacitor is installed is less than 2400 volts.



HOIST
Forearm vertical; make small horizontal circle with the hand

LOWER
Arm extended, hand below the hip; wave the forearm downward

STOP
Arm extended, hand below the the hip, hold position rigidly

Standard Crane Signals Mean Faster, Safer Moves

F. M. BLUM, Assistant Manager, Crane Division, Harnischfeger Corporation, Milwaukee

OPERATING an overhead traveling crane efficiently and safely calls for teamwork. The man at the controls and the men on the floor use the same "language." The language is a signal system that everyone understands. Without such signals, a moving crane hook, with or without a load, is as great a menace to safety as it is an aid to handling materials.

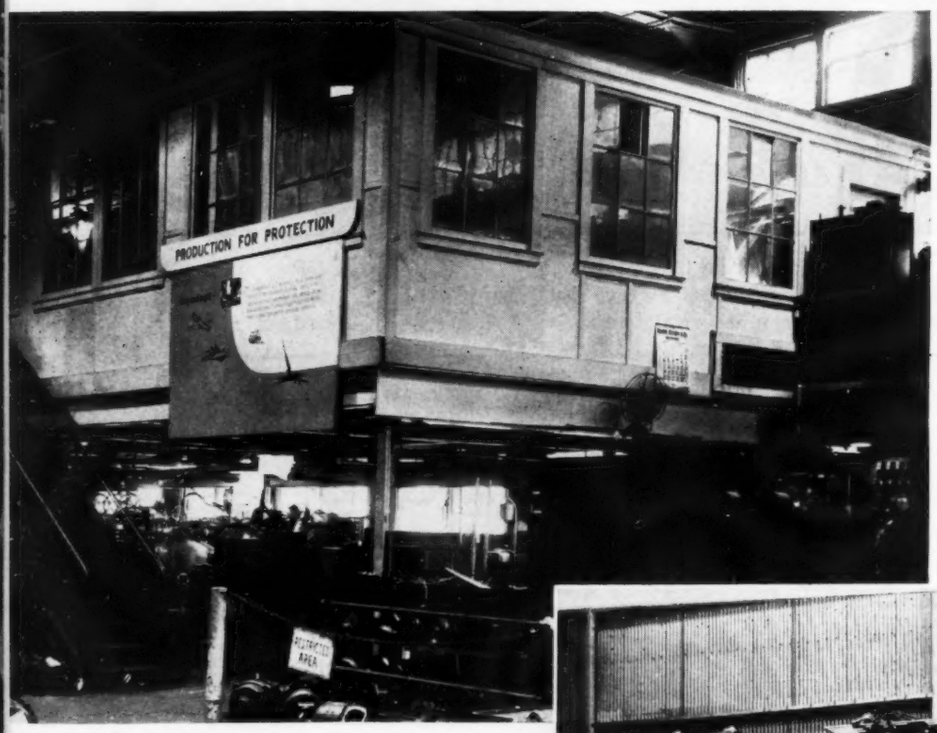
Now, with so many plants crowded and busy with war work, and with a constantly increasing number of inexperienced men entering into factory jobs, is a good time to make sure that crane men know the standard crane signals and are using them. The crane signals shown here are universally used. They are simple. They are easy to remember. They can be learned with only a few minutes' practice.

RACK
Arm extended, fingers closed, thumb horizontal, jerk hand in direction of racking

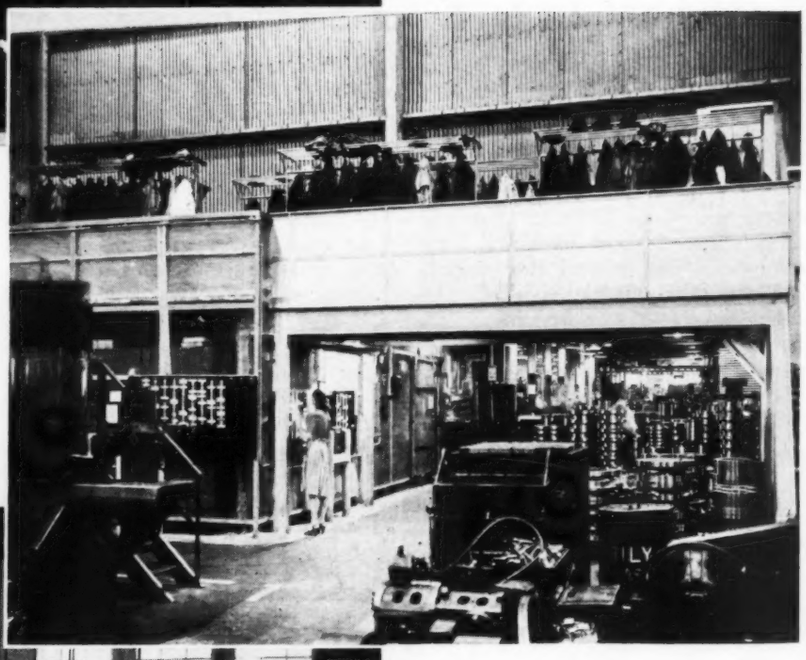
TRAVEL
Forearm vertical, hand open; wave the forearm in the direction of crane travel

EMERGENCY STOP
Arm extended, hand level with the hip; wave the hand quickly to right and left

For Extra Floor Space Try a



When every corner of the manufacturing floor is jammed with productive operations, a plant office on the mezzanine may well prove to be the answer. This one has an area of 1536 square feet



As more and more personnel is added to take care of war production, locker-room space becomes scarcer and scarcer. Here a mezzanine—419 square feet of it—does an outstanding job

There's no lack of air or light in this screw-machine shop office which, perched half way up the wall, uses space that otherwise might be going to waste. Area—2400 square feet

Mezzanine

How General Electric "found" floor space. Using "air rights" between floor and ceiling adds room for offices, lockers, storage

Patterns may not be used every day, and they take up a lot of valuable room when they are stored on production floors. Parking them on a mezzanine keeps them handy, yet out of the way

A place for everything—but when stock-storage space becomes crowded, confusion may result. An added 1268 square feet on top of a toolroom can provide needed extra space

Built between the factory floor and the ceiling, stockroom adds 4380 square feet of floor space. Stock is raised by a dumbwaiter at one end, shot down by slides to outside bays when needed

Pick Wire That Fits the Job

If the insulation on wire and cable is not selected with regard to its suitability for operating conditions there is bound to be trouble, because when this barrier breaks down current flow is no longer confined to the proper paths

G. M. VAN LEAR, Assistant to Chief Engineer, General Cable Corporation, New York

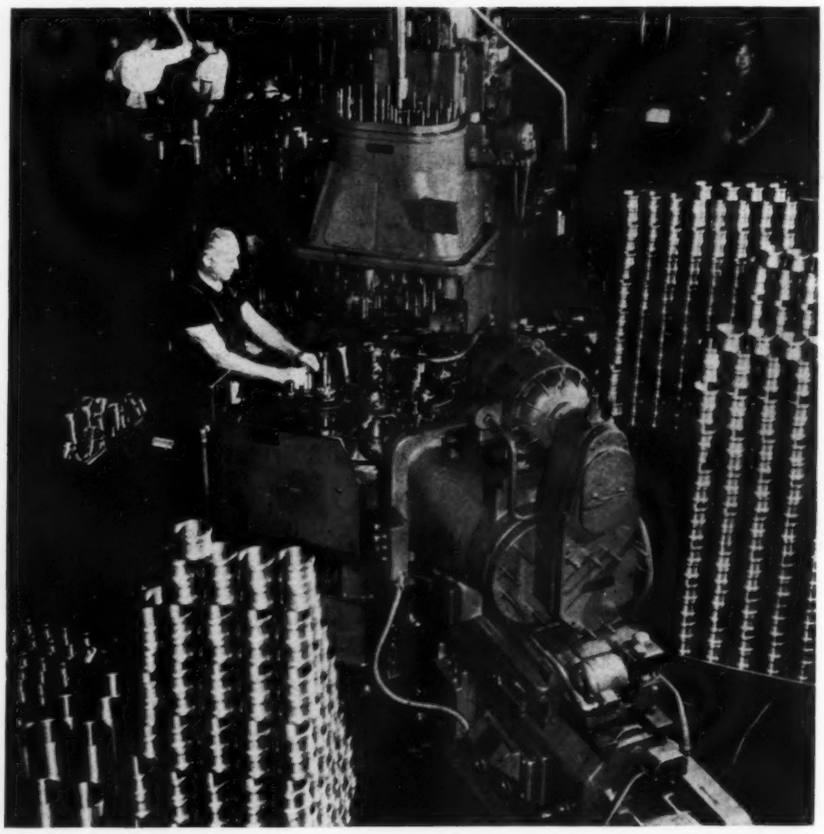
Most factory requirements for insulation can be satisfied by one of the four commonly used types: (1) Code grade rubber; (2) heat-resistant rubber; (3) varnished cambric; (4) moisture-resistant rubber. When special conditions are encountered, it is well to consult the cable manufacturer for recommendations.

Code and heat-resistant compounds respectively are Type R and Type RH grade of rubber-insulated "building wire" as provided for in the 1940 National Electrical Code and covered by standards of the Underwriters' Laboratories, Inc. They are more nearly stock items than any of the other insulations.

The essential difference between Type R and Type RH is only in the quality of the rubber compound. The relative quality is such that approximately the same life expectancy will develop when the operating temperature in service does not exceed 50 degrees Centigrade for Type R and 75 degrees for Type RH. Usually Type R is used for small-sized branch circuits where voltage drop rather than high copper temperature is the main consideration, whereas main feeders, carrying relatively large currents, can use Type RH to better advantage. A saving in copper usually is realized when Type RH can be operated near its limiting temperature of 75 degrees Centigrade.

The third insulation, Type V, is varnished cambric. It is recommended for use with copper temperatures up to 85 degrees Centigrade. This type is well standardized and is listed in practically all trade catalogs.

The fourth insulation is listed as Type RW in the 1940 Code and is approved by Underwriters' Laboratories for use in wet locations, without a lead sheath. It is of advantage to use Type RW in locations where condensations or alternately wet and dry conditions exist, because the other three types should have lead-sheath protection in such locations. The current-carrying capacity of Type RW wire is based on 50 degrees Centigrade maximum copper temperature, the same as Type R.



When power lines go out from insulation failure, production stops. Here, equipment for aircraft and tanks is being turned out

Still Another Type

A fifth type might be added, since its high-voltage, moisture- and ozone-resistant characteristics make it suitable for nearly all installation conditions. This is an oil-base type of insulation having a reliable service record of many years in general applications by industrial plants, electric utilities, and railroads. Its performance specification is covered by IPECA, ASTM, and NEMA standards for Ozone-Resistant-Type Insulation. Although it is not covered in the Underwriters' Laboratories standard for rubber-insulated wire and cable, several manufacturers have had enough experience to justify recommending it for interior wiring under the conditions prescribed for Type RW—that is, in wet locations without a lead sheath. Also, under certain conditions, it can be given the same current rating as Type RH. Makers should be consulted for recommendations by those unfamiliar with this material.

From this brief description of the various types of insulation available, the general recommendations shown in Table I may be set forth.

Since most installations come within the jurisdiction of the National Board of Fire Underwriters, it is desirable to use the current-carrying-capacity tables in the 1940 Code. These tables are considered by some to be too conservative, but the values are based on actual data obtained from a comprehensive test program conducted by NEMA and they can be recommended as sufficiently accurate for all general purposes.

In planning a circuit certain data are available as a starting point—usually the amount of power to be delivered at the load, the circuit voltage, and the distance. From these data the line current in amperes is easily calculated.

The first step in determining the proper conductor size is to make a tentative selection from the tables of current-carrying capacity. Table II is a modified form of Table I of the Code. The chart, Figure 1, is based on the same authority and presents part of the data in a more easily usable form. For example, for a power load of 100 amperes, the chart indicates the use of No. 2 A.w.g. Type RH, or No. 1/0 A.w.g. Type R conductors.

Motors coming under the rules of the Code require a somewhat larger size of conductor, as shown in Code Tables 20 to 24 inclusive. The table and chart shown here can be used, however, as the starting point for determining the proper conductor size in the average installation.

The next step is to check the voltage regulation or voltage drop, which, according to Article 2202 of the Code shall be not more than 3 percent for power loads and not more than 1 percent for lighting or combined lighting and power loads.

It must be remembered that excessive voltage drop can be expensive. The energy loss in the line conductors is almost directly proportional to the percent voltage drop times the delivered wattage. For example, the line loss in a circuit delivering 2000 watts with 5 percent voltage drop will be about 100 watts. This loss represents an annual charge which illustrates why it is often desirable and more economical in the long run to select a conductor size somewhat larger than the minimum allowable size.

In calculating voltage drop in circuits it is necessary to be able to judge which are the more important factors of the large number of variables that affect the results. Some of these factors are: Size and temperature of conductor; length of circuit; spacing of

Table I. Applications of Common Types of Wire and Cable

Voltage	*Dry*	*Wet*
0–2000 Small sizes	Type R	Type RW Type R leaded
0–2000 Large sizes	Type RH Type V	Type RW Type RH leaded Type V leaded
Over 2000	Manufacturer's recommendations	

Table II. Allowable Current-Carrying Capacities of Conductors in Amperes*

Size, A.w.g. or M.C.M.	*Type R Number of Conductors*			*Type RH Number of Conductors*			*Type V Number of Conductors*		
	1–3	4–6	7–9	1–3	4–6	7–9	1–3	4–6	7–9
14	15	12	11	22	18	15	23	18	16
12	20	16	14	27	22	19	29	23	20
10	25	20	18	37	30	26	38	30	27
8	35	28	25	49	39	34	50	40	35
6	45	36	32	65	52	46	68	54	48
4	60	48	42	86	69	60	88	70	62
2	80	64	56	115	92	81	118	94	83
1	91	73	64	131	105	92	138	110	97
1/0	105	84	74	151	121	106	157	126	110
2/0	120	96	84	173	138	121	184	147	129
3/0	138	110	97	199	159	139	209	167	146
4/0	160	128	112	230	184	161	237	190	166
250	177	142	124	255	204	179	272	218	190
300	198	158	139	285	228	200	299	239	209
350	216	173	151	311	249	218	325	260	228
400	233	186	163	336	269	235	361	289	253
500	265	212	186	382	306	267	404	323	283

* *Based on the number of conductors in raceway or cable at 30 deg. C. ambient temperature.*

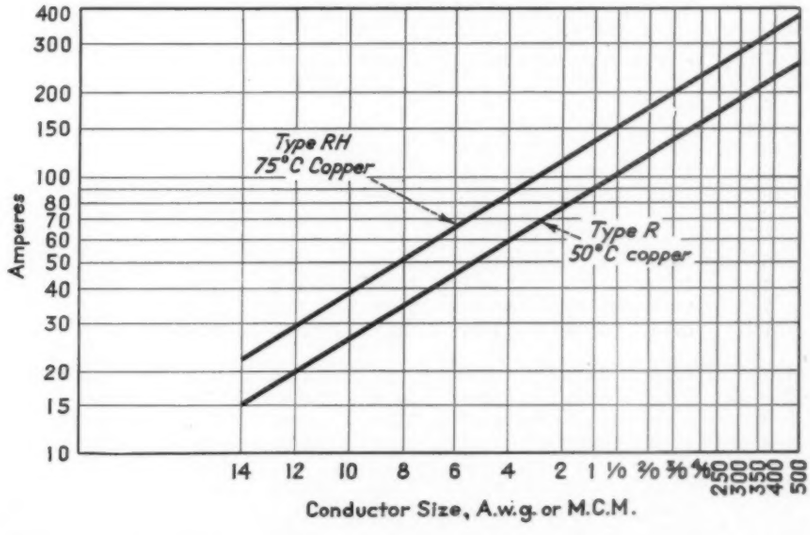


Figure 1. Allowable current-carrying capacity, in amperes, with not more than three conductors in raceway or cable and ambient temperature of 30 degrees Centigrade. Data are taken from Table II.

conductors; frequency in cycles per second; protective covering and conduit material; and power factor of the connected load or loads. Formulas covering these calculations appear in handbooks and textbooks.

Table III will be found useful and convenient. It covers the standard range of conductor sizes; direct-current circuits; 60-cycle single and three-phase circuits; 80 and 100 percent power factor; Type R and RH temperatures; and is applicable to any circuit voltage. It is simple to use and with some experience it can be employed to estimate problems with somewhat different variables. It covers a great number of cases that will be encountered in industry.

For want of a better designation the numbers in Table III are called "X" values. Actually, each X number is the product of line current and circuit length or "ampere-feet" for a one volt drop.

The solution to a problem can be obtained from one of the following relations:

$V=IL/X$ or $L=VX/I$ or $I=VX/L$,

where V is the drop in volts

I is the line current in amperes, and

L is the circuit length in feet.

A few examples will illustrate the practical use of Table III.

Example 1:

Find the wire size and type of insulation to deliver 20 kw. at 80 percent power factor on a three-wire 120/240 volt circuit a distance of 185 feet with a voltage drop of not more than 3 percent.

The line current, $I = 20{,}000 \div 240 \times 80 = 104$ amperes

The voltage drop, $V = 240 \times 0.03 = 7.2$ volts

$X = 104 \times 185 \div 7.2 = 2680$.

Referring to Table III under single phase 80 percent power factor, an X of 2680 indicates that No. 2 A.w.g. will be satisfactory from the voltage drop standpoint.

Figure 1 shows that No. 2 A.w.g. Type R will not carry the load of 104 amperes but Type RH will.

Example 2:

Find the maximum length of a three-wire 115/230 volt circuit of No. 8 A.w.g. cable carrying 40 amperes at 80 percent lagging power factor without exceeding 3 percent voltage drop.

Figure 1 shows the type to be RH since No. 8 A.w.g. Type R will not carry 40 amperes.

Referring to Table III under single phase 80 percent power factor at 75 degrees centigrade, X is 760. Then the circuit length for a 6.9 volt drop, $L = 6.9 \times 760 \div 40 = 131$ ft.

Example 3:

Find the maximum load that can be carried on a four-wire three-phase 60-cycle, 440-volt circuit of No. 6 A.w.g. Type RH cable for a distance of 200 feet without exceeding 10 volts drop.

From Table III, $X = 1140$ for 100 percent power factor and 1380 for 80 percent power factor.

Then $I = 10 \times 1140 \div 200 = 57$ amperes for 100 percent power factor, indicating a load of $1.73 \times 57 \times 440 \times 1$ or 43.3 kw.

Also $I = 10 \times 1380 \div 200 = 69$ amperes for 80 percent power factor, indicating a load of $1.73 \times 69 \times 440 \times .80$ or 42.0 kw. Note from Table I that 69 amperes will cause some overheating of No. 6 A.w.g. Type RH, so perhaps Type V could be used. Without overheating, Type RH will carry $1.75 \times 65 \times 440 \times .80$ or 39.5 kw.

Example 4:

Find the voltage drop in a 200 ft. 60 cycle three phase circuit planned to carry 150 amps. at unity power factor.

Figure 1 indicates No. 1/0 A.w.g. Type RH or No. 4/0 A.w.g. Type R. The corresponding X values from Table II are 4450 and 10200.

For Type RH, $V = 150 \times 200 \div 4450 = 6.74$ volts

For Type R, $V = 150 \times 200 \div 10200 = 2.95$ volts

NOTE: If the circuit voltage is only 115, the use of No. 1/0 A.w.g. with its 5.9 percent voltage drop may not deliver sufficient voltage at the load. It may be advisable to use the No. 4/0 A.w.g. Type R with its lower drop, or to operate the circuit at 230 volts thus cutting the percentage to 2.9.

It is a good rule not to use sizes larger than 500,000 circular mills for general purposes. Table II shows that the amperage per unit of cross-sectional area decreases rapidly with increasing conductor size. For this reason it will be economical in large capacity circuits to install two or more conductors in parallel instead of one large conductor per phase. In general, this possibility should be investigated when the load current is more than 100 amperes. Conduit costs also may be reduced since the price increases for sizes above 1½ inches.

Table III. "X" Values for Calculating Voltage Drop Per Ampere Per Foot of Circuit Length

A.w.g. or M.C.M.	D. C. or Single Phase				Three Phase			
	Power Factor — %							
	100		80		100		80	
	Temperature Rating							
	50	75	50	75	50	75	50	75
14	172	168	208	193	200	180	250	230
12	270	260	330	310	316	286	395	360
10	425	408	520	485	500	460	620	565
8	690	640	826	760	800	720	990	880
6	1090	1020	1270	1180	1250	1140	1500	1380
4	1710	1600	1940	1810	2000	1800	2270	2060
2	2720	2500	2930	2720	3200	2900	3460	3150
1	3450	3180	3550	3270	4000	3600	4150	3800
1/0	4250	3900	4250	3920	4950	4450	4950	4600
2/0	5500	5050	5200	4800	6400	5700	6050	5600
3/0	6900	6300	6200	5750	8000	7100	7200	6650
4/0	8740	8000	7530	6960	10200	9200	8600	7950
250	10400	9400	8300	7700	12000	10600	9600	8900
300	12500	11300	9350	8700	14400	12900	10600	10000
350	14500	13000	10400	9600	16800	15000	11800	11000
400	16600	15000	11200	10400	19200	17100	12700	12000
500	20800	18700	12700	11900	24200	21700	14600	13600

Note: The current in amperes must not exceed the values given in Table II.

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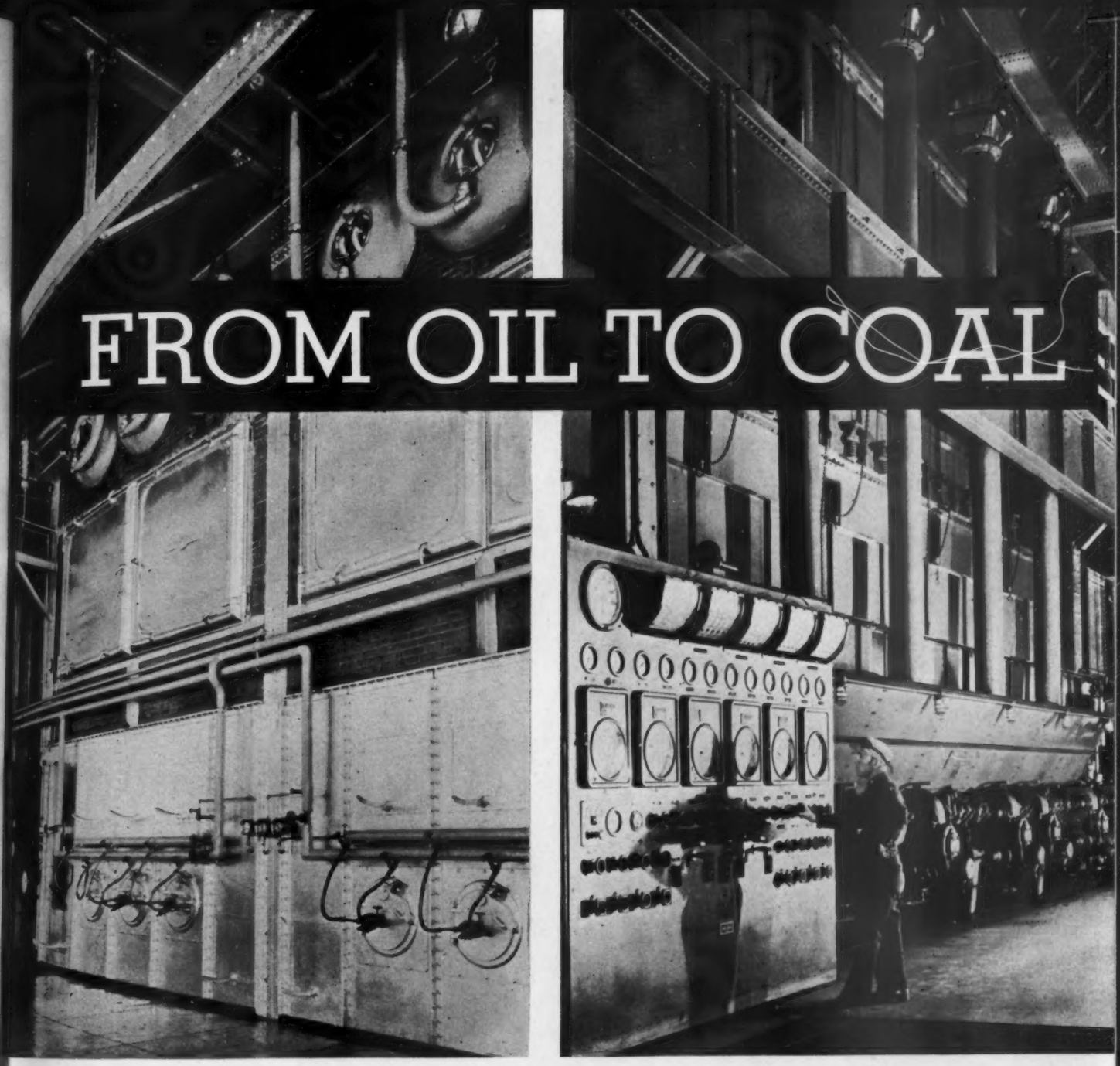


FROM OIL TO COAL

DAVID MOFFAT MYERS
Consulting Engineer, New York

MANY INDUSTRIAL PLANTS must discontinue or reduce the consumption of fuel oil used for steam generation. This war measure presents special engineering problems.

What is the best way to swing over from oil to coal? The answer depends upon the existing situation in the individual plant. Therefore there are many answers.

There may be a few cases in which the various determining factors are so alike that the same solution will serve. But these cases are few, and no fixed formula is possible.

It is possible, however, to set forth and discuss the various conditions found in different plants and to indicate the appropriate study that will lead to the right answer, if followed with experienced engineering skill and knowledge.

It is relatively easy to change from coal to oil burning in the average boiler plant, but the reverse operation usually involves greater difficulties and expense.

There are several reasons for this, two in particular. First, much more combustion space in the furnace is required for coal. Stoker-fired coal may be burned at rates in the order of 50,000 to 70,000 B.t.u. per hour per cubic foot of furnace volume. Hand-fired coal should be allowed considerably more combustion space. Pulverized coal is efficiently burned at rates from 12,000 to 35,000 B.t.u. per cubic foot, depending upon the design and the water-cooling arrangement of the furnace.

Oil, on the other hand, can be efficiently burned at rates up to 300,000 B.t.u. per cubic foot per hour, when furnace conditions are right, and

100,000 B.t.u. would be good practice. One of the modern oil-burning boiler units in which combustion takes place under 30-lb. pressure gives a heat release of close to 1,000,000 B.t.u. per cubic foot.

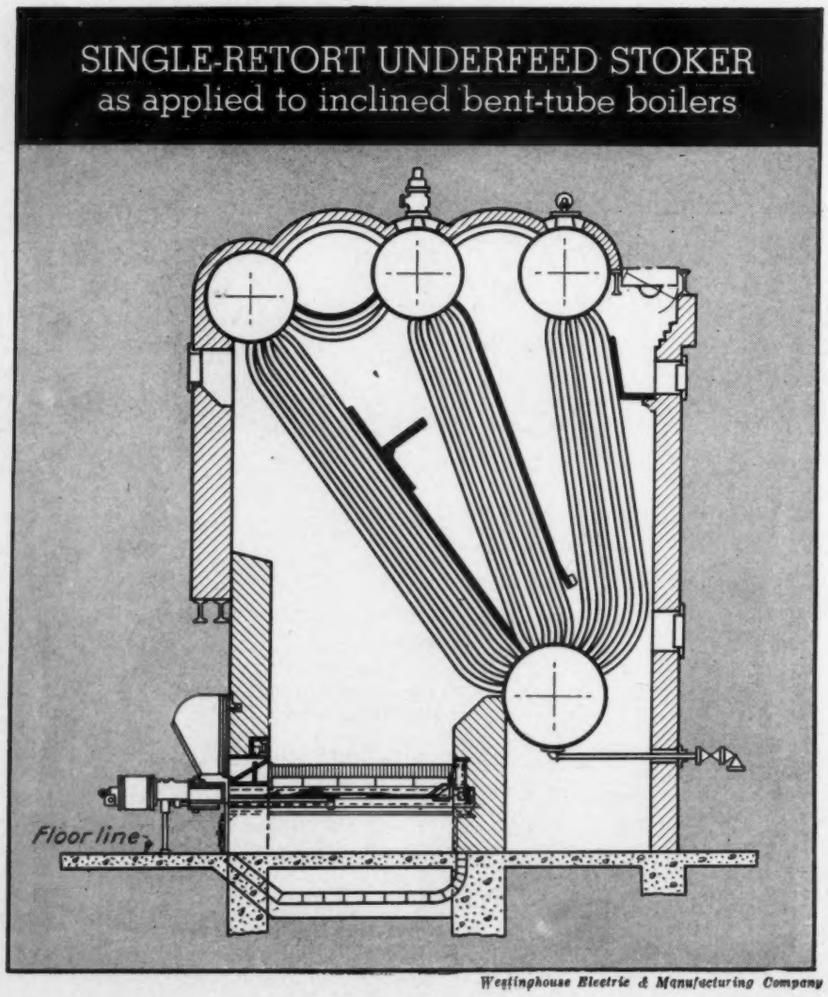
From the above data, speaking in broad terms, we can say that, for the same heat release or steaming capacity, oil requires less than half the furnace volume required by coal. Hence, when our plant is designed for oil and we have to change to coal we may run into difficulty in trying to get sufficient steam out of the same boilers. Incident to this first difficulty is a further aggravation when we install stoker or grates under the boiler, because they further reduce the combustion space.

The second outstanding difficulty is the requirement for coal- and ash-handling equipment. If the plant had been coal-fired during some earlier period, the old equipment could perhaps be repaired and again put in operation. If no such apparatus is available, then it must be secured and installed, if reasonable labor cost and cleanliness in operation are important, as they generally are. In small plants the old dirty and laborious manual handling of coal and ashes may be decided upon as the choice of evils.

As a part of coal handling, coal storage is of real importance these days, both as a protection to continuous operation and as an aid to our national mining and transportation problem. Excellent systems and equipment are available today which provide both handling and storage of coal and ash in a most convenient and efficient manner.

The installations can be engineered to cause minimum disturbance or construction in an existing boiler house. With a good priority such equipment can be obtained within a reasonable time.

Let us return now to the question of steaming capacity when a plant is changed from oil to coal burning. Many a plant, of course, was originally designed to burn coal, and did so for a long period; then came a time when, for one reason or another, the plant was changed over to oil burning.



Westinghouse Electric & Manufacturing Company

In a situation of this sort, wherein the steam load on the boilers was not increased when oil burning was installed, it should be possible to change back to coal burning with a minimum of difficulty and expense.

However, many plants were changed over to oil burning some years ago largely because sufficient steam could not be secured from their coal-burning equipment, and they are now running on oil at the more or less full capacity which that fuel can give. In such cases the problem is no longer so simple. Of course, if there are spare boilers in the plant, the reduced capacity per boiler may be compensated by operating more boilers.

If you are operating all your boilers up to capacity with oil and have no spares, and if, let us say, new boilers are out of the question, then other measures must be considered. For example, it may be possible to double the combustion space and thus get equal capacity per boiler with coal.

There are three ways of doing this: (1) Raising the boiler; (2) utilizing the sub-basement under the boiler if it exists, or excavating; (3) building an extension furnace in front of the boiler, preferably with water walls.

Raising the boiler, often, though not always, requires raising the boiler-house trusses and roof.

Utilizing a sub-basement may cost less but leaves the problem of ash removal, not an insurmountable one if certain types of stoker are used.

An extension furnace introduces the problem of maintenance of brickwork. However, if furnace water walls can be readily incorporated with the boiler, the added heating surface substantially aids both steaming capacity and furnace maintenance.

There are several types of coal-burning equipment to be considered in our general problem; the following list does not include every possible modification:

1. Hand-fired grates, shaking, dumping, or stationary, with or without forced draft.
2. Underfeed stokers of single- or multiple-retort design.
3. Overfeed stokers.
4. Chain-grate or traveling-grate stokers.
5. Spreader stokers.
6. Pulverized coal.

Let us first of all examine in some detail each of the above-listed types of coal-burning equipment. This is necessary in order that we may reach

a conclusion as to the best measures to be adopted if the change is to be made from oil to coal.

1. Hand-Fired Grates

Hand-firing may be the answer in the smaller plants, provided the grates can be set far enough below the boiler heating surface to give ample combustion space. A moderate forced draft is a great aid in securing steaming capacity, but boiler internal surfaces must be kept clean to avoid burning, blistering, and bagging. The design of grate must be appropriate to the type of coal to be burned, and efficiency will be improved by one of the simpler automatic furnace-draft control systems.

2. Underfeed Stokers

Underfeed stokers here considered are of two general designs: (a) The single-retort type in which the coal travels laterally outward from the central retort toward dumping plates at the sides for disposal of ash; (b) the multiple-retort type in which the coal entering at the front travels longitudinally through the several retorts and over the tuyeres toward the rear and downward for disposal of the ash through a clinker grinder or some suitable dumping device. Underfeed stokers of the larger industrial type are designed especially for bituminous coals of low and medium ash content.

The advantage of the single-retort stoker is that it can be installed in much smaller space than the multiple type. The ash can be raked out at fire floor level and disposed of either by hand or by a vacuum system.

Proper installation of the multiple-retort stoker requires a considerable ash pit and should have a tunnel or sub-basement for the disposal of ash. Otherwise the boiler must be set high enough to permit ash handling at fire-room floor level. It is therefore a more costly installation, and the stoker itself is more expensive. It is considerably more efficient, however, than the single-retort stoker and is capable of handling a wider variety of coals.

Both types of stokers require mechanical draft. Automatic combustion control which maintains proper furnace draft and a correct air-fuel ratio should be a part of the equipment if best results are to be obtained.

3. Overfeed Stokers

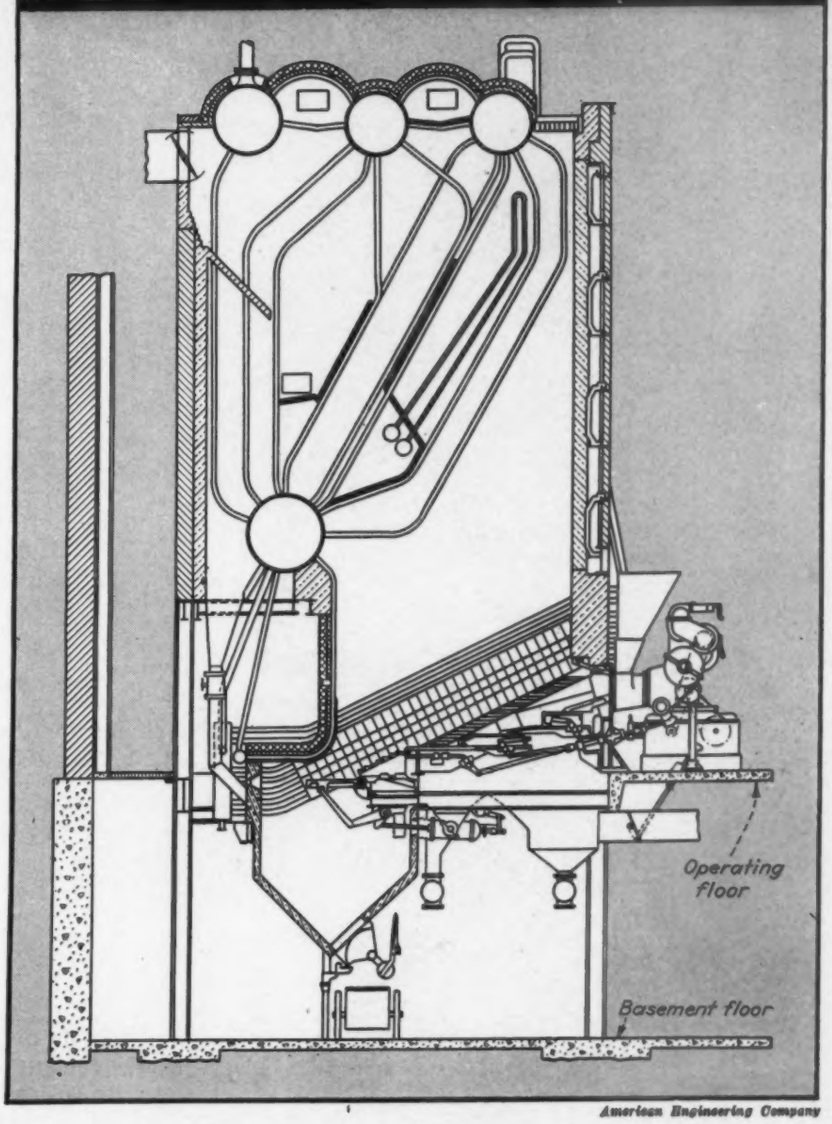
Overfeed stokers are designed to receive the coal from the hopper on dead plates at the front end, from which it is impelled downward by a rocking action of the grate bars toward the low end at the rear where the ash is discharged.

Like the multiple-retort underfeed stokers, overfeed stokers require a spacious ash pit or tunnel for the disposal of the ashes which, in turn, means a higher boiler setting or an excavation below the stoker.

The overfeed stoker frequently operates on natural draft, although better capacity and control are obtainable if forced draft is applied; it is likely that forced draft will be necessary in replacing oil fuel to secure equal steam output from a given boiler.

Automatic combustion control is advisable also in this type of stoker. The overfeed applied principally for bituminous coals has also been successfully designed for small anthracites.

MULTIPLE-RETORT UNDERFEED STOKER
with ash-disposal equipment



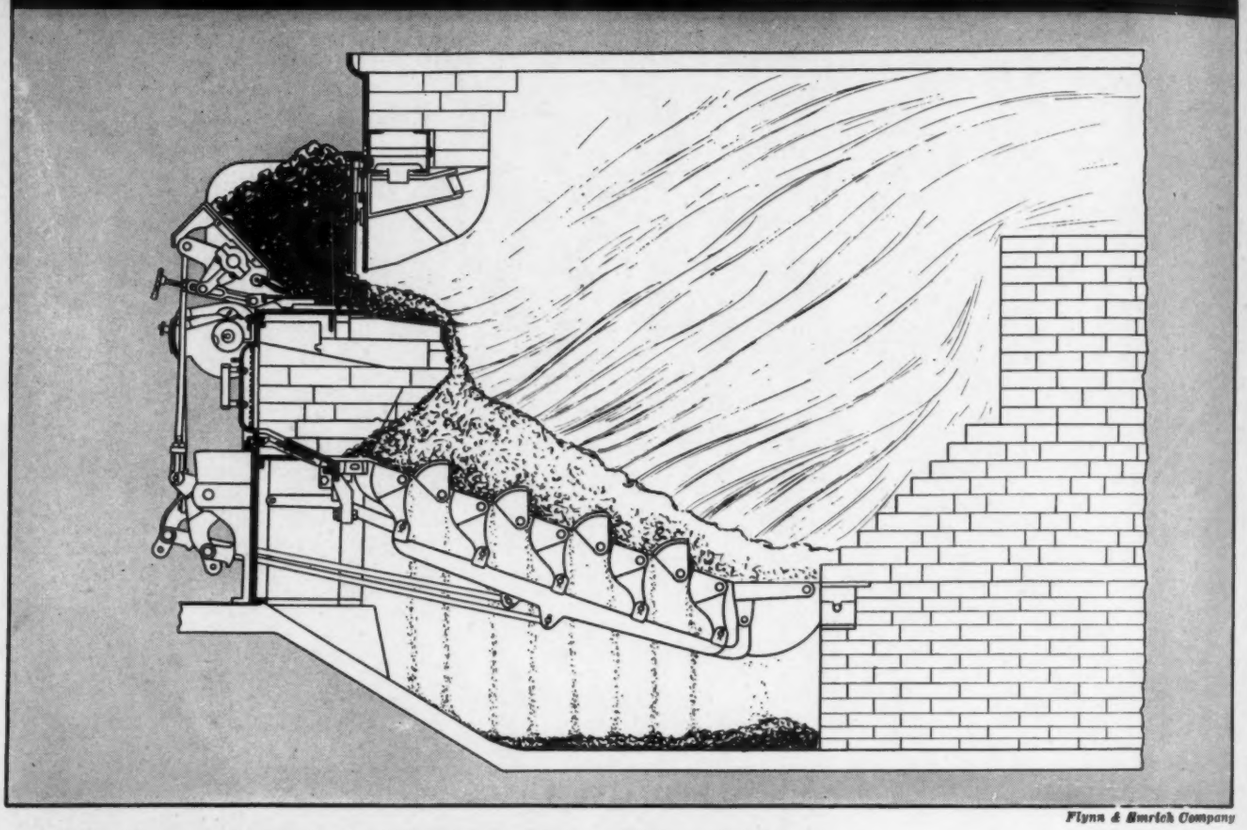
American Engineering Company

4. Traveling Grates

Chain and traveling grates are designed primarily for free-burning coals which have little or no tendency to cake or coke, and burn well without agitation. They are particularly adapted to high-ash coals that usually do not cake or coke. The traveling grate is the most efficient combustion equipment for burning the small sizes of anthracite. Free-burning bituminous and sub-bituminous coals burn best on chain-grate stokers.

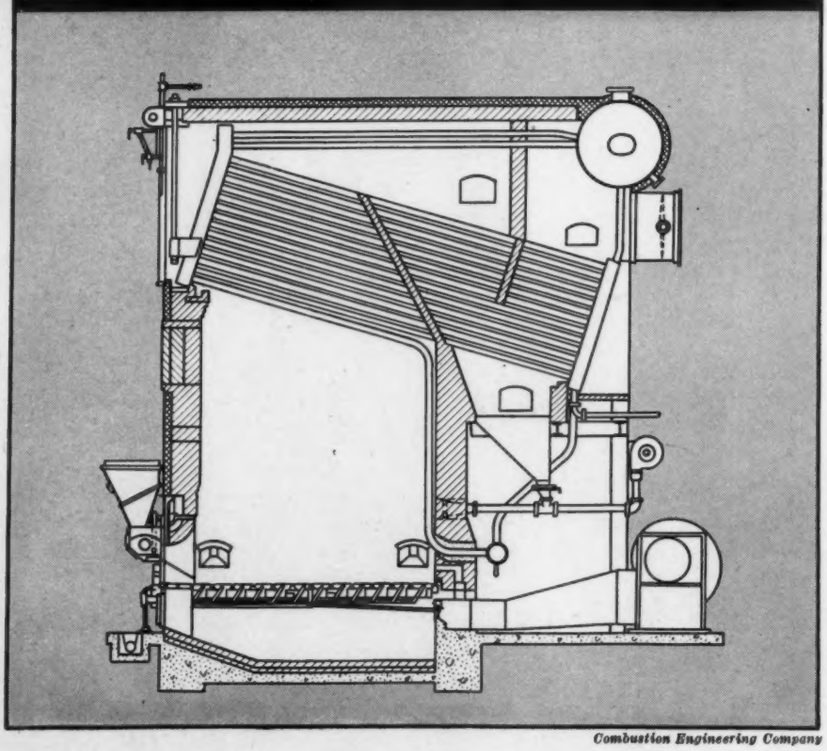
Stokers of this type are costly to buy

OVERFEED STOKER (FULL-AUTOMATIC TYPE)



Flynn & Emrich Company

SPREADER STOKER



Combustion Engineering Company

and install. A deep ash pit or subbasement is required for disposal of the ash. There are special cases where this stoker must be considered as the most effective apparatus for the burning of certain fuels. Mechanical draft is required, and automatic combustion control should always be applied.

5. Spreader Stokers

Spreader stokers are an old invention that has recently been much improved. The coal is introduced through a hopper at the front of the furnace, from which it is injected into the furnace in the form of a spray by means of a mechanical, steam, or air device. The grate surface is substantially flat, which means that a minimum of space is occupied by this form of stoker. Ashes can be pulled out in front at the fire floor level just as in the hand-fired furnace so that this phase of the problem is relatively simple. The spreader stoker operates best with bituminous coals, particularly those containing high percentages of volatile matter. Much of the fines of the coal burn in suspension over the grate, while the heavier particles drop to the grate and are consumed there.

Forced draft is used with special air admission, and it is extremely important to maintain a carefully controlled furnace pressure and proper velocities of draft as well as the right air-fuel ratio. The better designs of the modern spreader stoker have shown very good efficiencies and can be readily installed. It is necessary, however, with this type of stoker to install some type of cinder-catching device because there is considerable carry-over through the boiler passages and into the flues and stack. As part of this carry-over is combustible, the best installations provide a return to the furnace of the unconsumed portion so retrieved.

6. Pulverizers

Pulverized coal requires a greater furnace volume for its combustion than any of the foregoing types of burning equipment. Although this system can be used with ordinary brick boiler settings, the heat release per cubic foot must be kept at a low point—that is, in the neighborhood of from 12,000 to possibly 15,000 B.t.u. to avoid undue furnace maintenance. A somewhat higher rate of combustion can be established with air-cooled furnace walls, as in many of the earlier designs. Even with water-cooled furnaces the combustion rate in usual cases is limited to about 35,000 B.t.u. per cubic foot per hour as previously indicated. From these statements it will be seen that the pulverized coal system suffers a serious disadvantage as a substitute for oil, unless special conditions obtain.

For example, the plant in question may have enough spare boilers so that the owner can afford to reduce the steaming capacity per boiler by operating more boilers to compensate. It may be possible to install an extension furnace on an existing boiler to make the use of pulverized fuel feasible, especially if the boiler design permits the addition of water walls for the improvement of maintenance and the increase of steaming capacity.

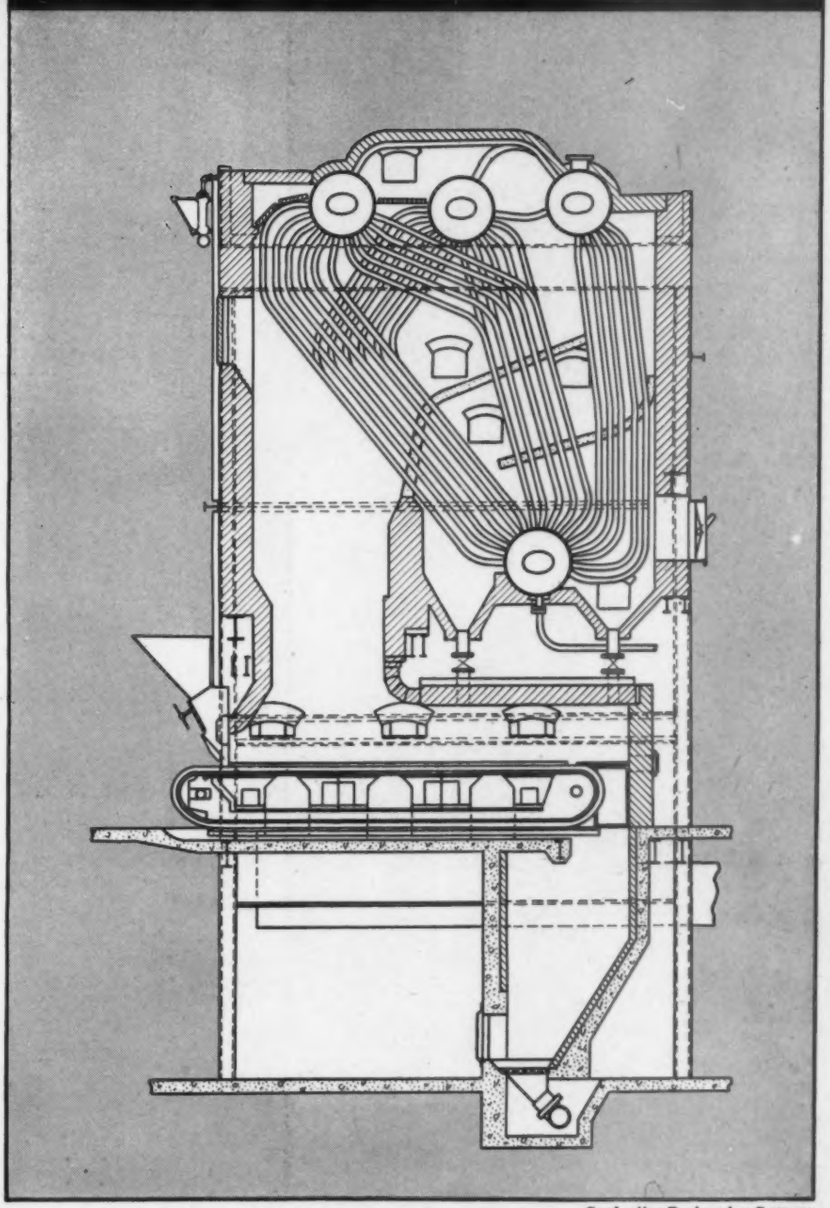
For the best results with pulverized coal, forced and induced draft should be incorporated with a complete system of automatic combustion control. There should also be provided an air preheater which reduces the temperature of the exit flue gases and adds the equivalent heat to the supply of air for the combustion of the fuel. Such a system when properly installed may operate day in and day out at 80 to 86 percent efficiency.

One limitation that must be observed is that low fractional loads cannot be obtained to the same extent as with mechanical stokers, which are capable of running at any capacity from banked load up to full load. With pulverized coal, anything better than a load variation of from 1 to 5 is considered rather unusual. Better than this can be secured by special planning of mills and burners—which, however, adds to the cost of the original installation .

While this limitation may in some cases constitute a disadvantage, there is an offsetting advantage in that a pulverized coal burner is capable of meeting sudden changes in steam demand automatically and with great rapidity.

In the furnace of a pulverized coal-burning boiler developing 60,000 pounds of steam per hour, there is at any one time a small amount of fuel, in the order of from 2 to 3 pounds. This fuel stays in the furnace about 1½ seconds for its complete combustion. It is fed into the furnace at the exact rate at which steam is produced. The result is that with auto-

TRAVELING-GRATE STOKER
with ash-disposal equipment



Combustion Engineering Company

matic control great speed and accuracy are secured in meeting load changes.

The stoker, on the other hand, producing the same quantity of steam, would have about 2 tons of burning coal on its grate, hence more of a lag with sudden changes of load in steam requirements.

Provision for coal and ash handling with pulverized coal may be virtually the same as for stoker installations up to a certain point. The coal may be stored and brought to the pulverizer by the same methods. The ash from the furnace may be disposed of through a vacuum system. The collecting bin for this ash must be provided with an automatic mixer at the discharge to dampen the ash sufficiently for transportation in a truck.

In a pulverized-coal-burning plant, roughly speaking, about one-half the fly ash goes out of the boiler and up the stack, the balance being precipitated in the bottom of the furnace or caught in boiler passages. It is the latter portion which is disposed of in the vacuum ash system just mentioned. Usually it is necessary to install a dust collector to catch the major portion of the fly ash which would otherwise go up the stack and into the atmosphere. There are various forms of dust catchers for this purpose, the most expensive and most efficient being the Cottrell process of electrical precipitation. For the usual boiler plant, however, one of the mechanical forms is amply effective. This type of dust catcher will remove from 50 to 90 percent of the dust in the gases, depending upon the design specified.

Look for All Six

In order to reach a conclusion as to the best measures to be adopted in converting from oil to coal fuel, all of the aforementioned kinds of burning equipment must be thoroughly understood, and it must be known in advance what results will be obtained by applying any of them to existing boilers.

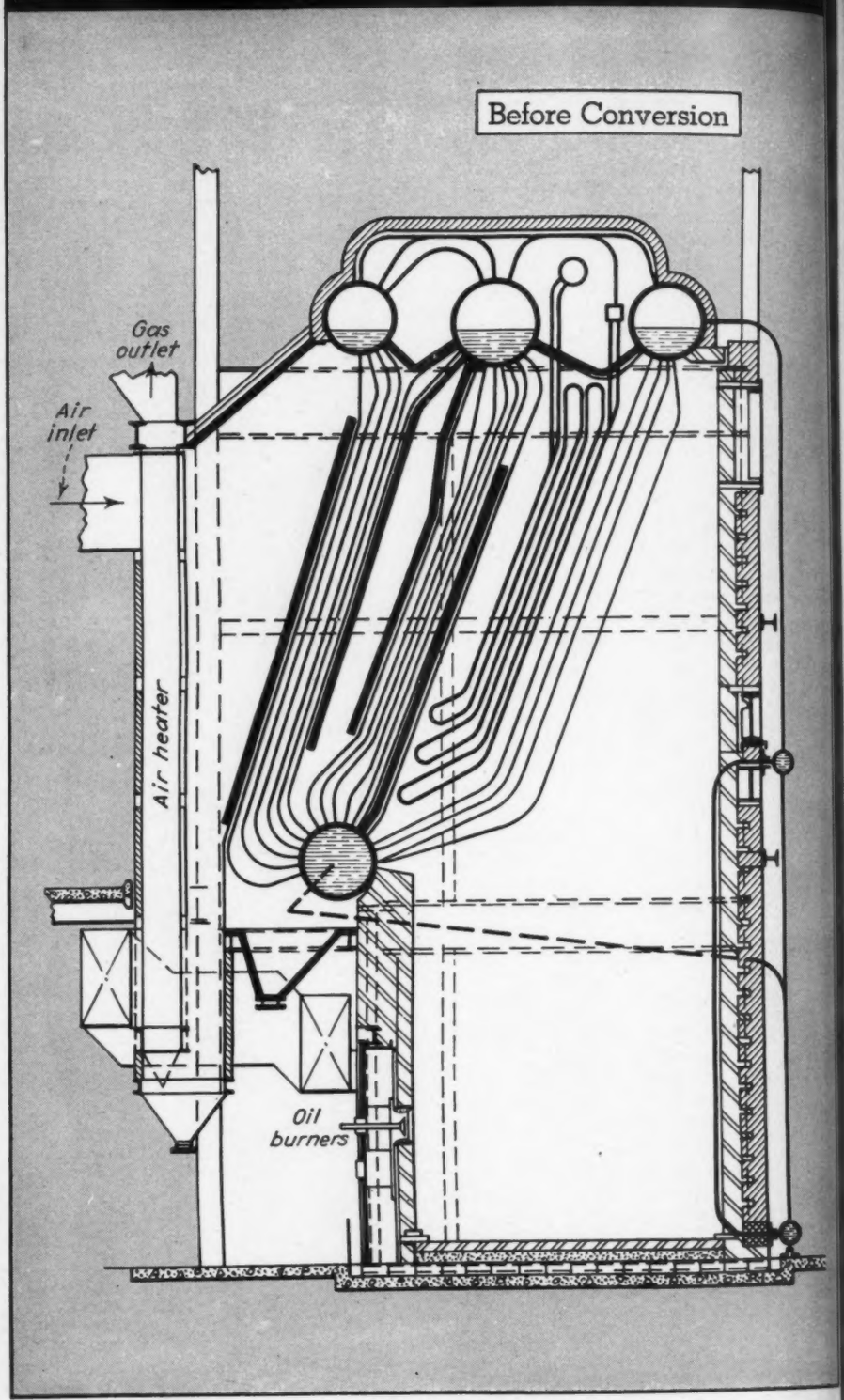
The cost of equipment plus its installation must be carefully estimated in order to secure a comparison of the expenses involved by the several possible applications.

The efficiencies of these different plans should also be considered, although today with the situation regarding procurements and priorities what it is, efficiency cannot always be regarded as the determining factor.

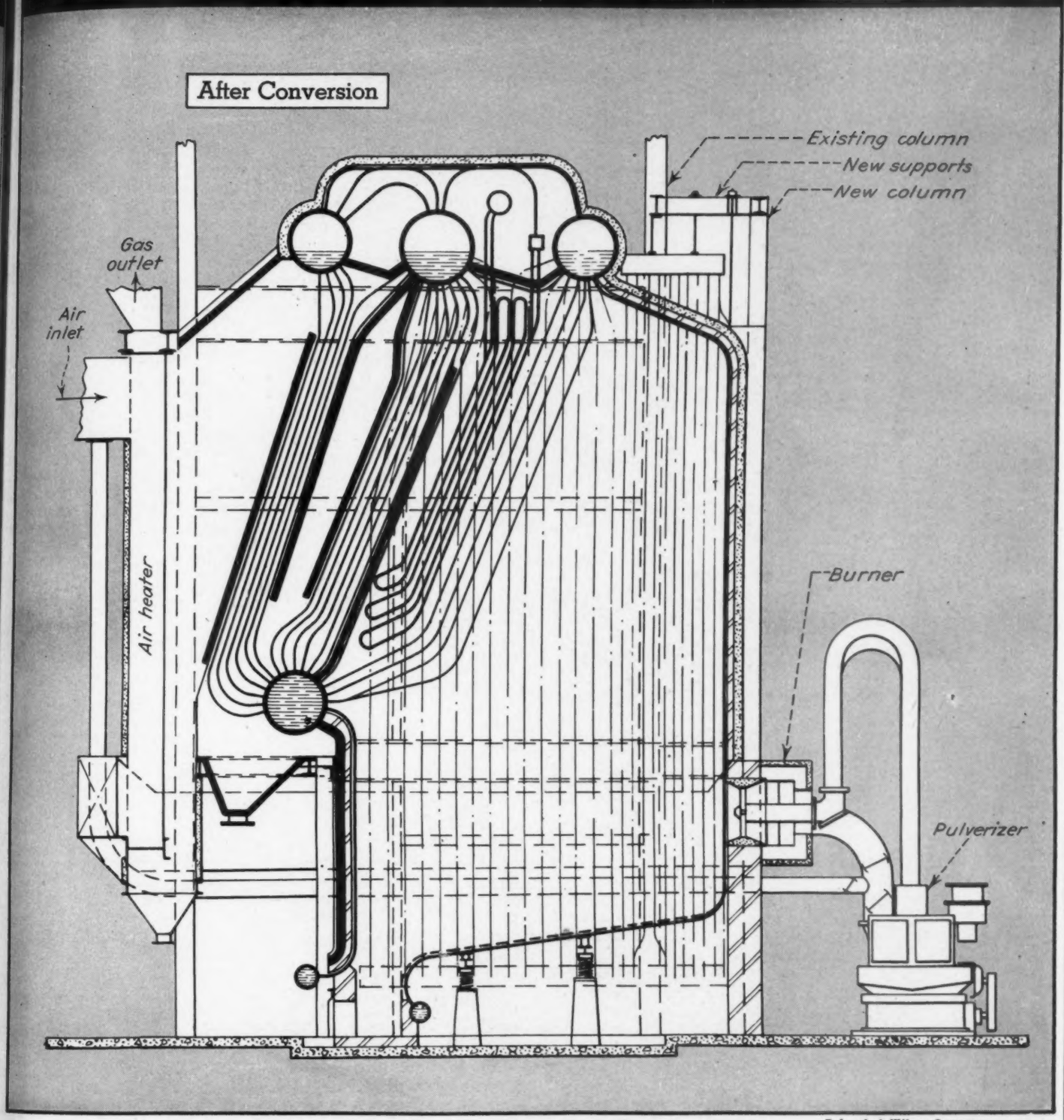
A survey thus far will have indicated what can be done and what it will cost to convert existing oil-fired boilers to coal burning, and also the time of delivery of the necessary equipment with the priorities that are obtainable.

Even after all this has been done, the whole problem has not been covered. For example, consider a plant (and there are many such) in which the boiler equipment is antiquated and virtually obsolete. Furthermore, with the modern methods of higher pressures and topping turbines and the large savings thereby obtainable, the old boilers would in normal times be considered to have served their purpose and would now be ready for the scrap heap. In other words, there

CONVERSION FROM



OIL FIRING TO PULVERIZED COAL



Babcock & Wilcox Company

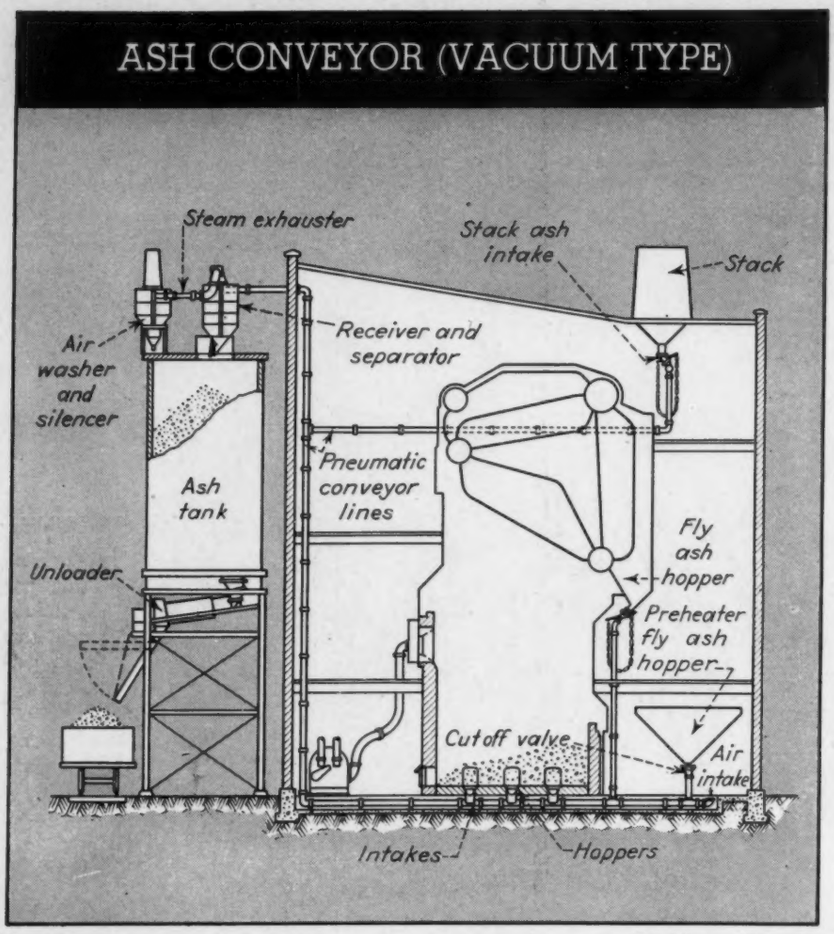
are many plants where a radical change to modern units and design would pay handsome dividends.

Owners of such plants will want to think most carefully before they spend large sums in converting their old boilers to coal burning when in most cases it will be virtually impossible to utilize this combustion equipment in any new modern plant in future years.

Storage and handling systems for coal and ash may be planned for adaptation to future boilers, but it is difficult to recover the value of other equipment bought for the present emergency unless applied to relatively recent boiler installations.

A stoker bought for an existing old-fashioned brick-set boiler is not likely to fit into a modern internally fired water-walled steam generator which also will likely be of double (or more) the steaming capacity of the old unit. Neither will the draft equipment be usable. Perhaps some parts of the combustion control might be salvaged.

Air preheaters would not fit the



United Conveyor Corporation

new units, and fly ash collectors and cinder catchers would be useless.

So, generally speaking, conversion of really old boilers to coal burning must be regarded purely as an emergency measure. Such conversion must be carried out in all cases when so indicated by a survey of conditions.

From the standpoint of the owner, it is highly desirable that expenditures made now on a plant should serve the future program efficiently. If the present plant is old and obsolete, the owner would naturally prefer to spend his money on the most modern and efficient boiler units possible rather than put capital into a job of patching up a worn-out and wasteful old plant.

Therefore, new modern boiler units should at least be considered at the present time. Priorities for securing both emergency equipment and modern boiler units must be determined. It is logical to believe that when federal authorities determine it is necessary for a plant to change from oil to coal, these same authorities will grant sufficient time and priority for the changes, especially if the plant is producing essential war material.

Tests have shown boiler efficiencies up to about 94 percent of the heat of the fuel converted into useful heat in the form of steam. Such high efficiency, however, is not usually economical because, to secure it, it is necessary to expend a disproportionate amount of investment for heat-catching devices. In other words, the law of diminishing returns is in full action.

It is found in general practice that it does pay, depending largely on load factor, to design boilers for efficiencies of 80 to 88 percent. As a consequence of these high existing efficiencies, there is little danger that a modern unit of today's design will be obsolete for its lifetime.

The progress in the last ten years has made no improvement in attainable efficiencies. Such improvements as have been made, have been in the field of mechanical detail. These will continue to advance and may be used later in an existing boiler plant.

Another fact that argues for the modern boiler unit is that one of these units can replace four to six of the old boilers at a saving in fuel, labor, and maintenance sufficient to pay off the new investment in from three to six years.

One problem, in case it is decided to install new boiler units, is to predict with sufficient accuracy the pressure, superheat, and steam capacity required. Also, with a view to the possibility of making as much by-product power from the manufacturing steam as may be economically possible, estimates must be made of the electric power demand and of the manufacturing steam demand to secure a ratio between these two values, including their 24-hour and weekly characteristics.

Although it is altogether probable that this cannot be done exactly at the present time, it should be possible to establish maximums and minimums within which the new boilers must operate.

A great deal of leeway can be allowed at small expense by purchasing a boiler capable of operating at a higher pressure than predicted. If it turns out that not so high a pressure is needed, the boiler can be operated at the lower pressure to fulfill the economic conditions.

It is often wise to install one or two modern units to carry the whole plant load, with one or more units as spares, and use the old boilers for standby purposes as well, if and as long as they are serviceable.

Emergency combustion and auxiliary equipment can be obtained much more quickly than new boilers, which is an argument on the other side—that is, in favor of some kind of temporary arrangement.

Be Ready to Act Quickly

There is a specific objective to which this article is pointed. That is to get industry to prepare. Be prepared for the emergency of changing from oil to coal in your plant. You may not be compelled to make such a change, but, if the order comes, you and I and the government should like to have it done just about the day before yesterday. The best procedure for you, therefore, is to make your survey now. Secure all the necessary operating data and facts; get proposals covering the apparent possibilities; compare costs, time elements, and practicabilities of the different plans. Be governed by experience and the best advice. Be prepared to act quickly if and when you get the order to shoot.

You cannot buy immediately what you may require, but you can start work immediately on the necessary survey, so that an unnecessary delay of from one to three months may be avoided.

How to Add Years to Compressor Life

Follow manufacturer's instructions, oil and clean regularly, watch water and air intakes—and air compressors will do their part in keeping production flowing

CHARLES W. GIBBS, Engineer, Ingersoll-Rand Company, New York

COMPRESSED AIR is an essential power in the production of many raw materials, and in their handling, processing, and purification. Therefore, take good care of air compressors so that your share of the production of war materials may not be delayed.

Just what constitutes "good care?" First and foremost, of course, is proper operation. Second, prompt maintenance and repair. Both must be more than ever preventive; both require a knowledge of causes and cures.

Perhaps it is trite to suggest that operation and maintenance of compressors should be the responsibility of one man or group of men especially selected for the job. This is a recommended set-up.

Compressor builders are anxious that their product be installed and operated properly. To this end, instruction books are sent out with each machine. See that such books are on hand and used. Any manufacturer will be glad to send duplicates if you write giving full nameplate information. Be sure to include the serial number.

It is important, for satisfactory operation, that compressors be run at or below their rated speed and pressure. Ratings are usually stamped on the nameplate. If they are not, ask the manufacturer. Be sure operating conditions are not excessive.

The most frequent compressor troubles can be traced to faulty lubrication. An improper grade of oil or too much oil is the usual cause. Too little lubrication is a condition that is seldom encountered.

Most frequent compressor troubles can be traced to faulty lubrication —improper grade of oil or too much. Use only enough to keep cylinder walls and valves coated. A little good oil will do this

Manufacturers of lubricants recognize the need for using only the best oil in compressors and are in a position to make proper recommendations for any particular service. Such oil may seem to be rather expensive per gallon, but it will usually be least expensive per hour of compressor operation. Use only the best.

Use only enough oil to furnish lubrication—enough to keep the cylinder walls and valves coated but not wet. A small quantity of good oil will do this. A large quantity of poor oil may lubricate the compressor but will cause carbonized valves and excessive temperatures.

A new unit requires more oil than one that is well run in. After a week or so of operation, cut down on the oil feed and adjust to the minimum supply that will keep cylinder walls and valves just oily.

The above applies principally to the air cylinders of horizontal machines having separate lubrication systems for crankcase cylinders. The crankcase may have a splash or full force-feed system. The lubrication requirements of the shaft, bearings, and

parts inclosed in the crankcase are less severe than those for the air cylinders, so that crankcase oil need not be as high a grade, although many users find it profitable to use the best throughout. Crankcase oil should be changed every 90 days or less.

In vertical type compressors cylinder lubrication is dependent on splash from the crankcase and is not subject to much control by the operator. The best oil, of course, is required here. Prevention of excess oil in the cylinder is dependent on the oil level in the crankcase. The correct level is marked on a gage, and should never be permitted to get too low or too high.

Some large vertical or "V" type units have a constant level system in the crankcase arranged so that the level in the pan from which the oil is splashed to the cylinders is always maintained. This feature eliminates much of the danger of over- or under-lubrication.

On vertical units oil should be changed more frequently than on horizontal units. The exact time will depend on the service.

A clean air supply to the compressor is important. Dust, scale, soot, steam, and water should be excluded by protecting the intake from the entrance of foreign materials. Take the air from as cool a spot as possible, high enough to escape ground dust and protected from the entrance of rain or snow. It should be unnecessary to suggest that air intakes must never be near the exhaust from sand-blasts and paint-spray booths.

Filters Must Be Clean

Intake air filters have wide acceptance, selection depending somewhat on the size of the unit and the surrounding conditions. Filters are only of benefit when serviced, kept clean, and in efficient working order. They cannot be installed, given a pat on the back, and then forgotten. Routine inspection and cleaning are a necessity.

Compressor operation will be more economical and maintenance will be reduced if care is taken with the cooling system of the unit.

The horsepower used to drive a compressor is all transformed into heat in some form. The most efficient theoretical compression cycle removes this heat as generated and maintains the air at the intake temperature. Although this is not possible in commercial design, it is universal practice to cool the air as much as possible during compression.

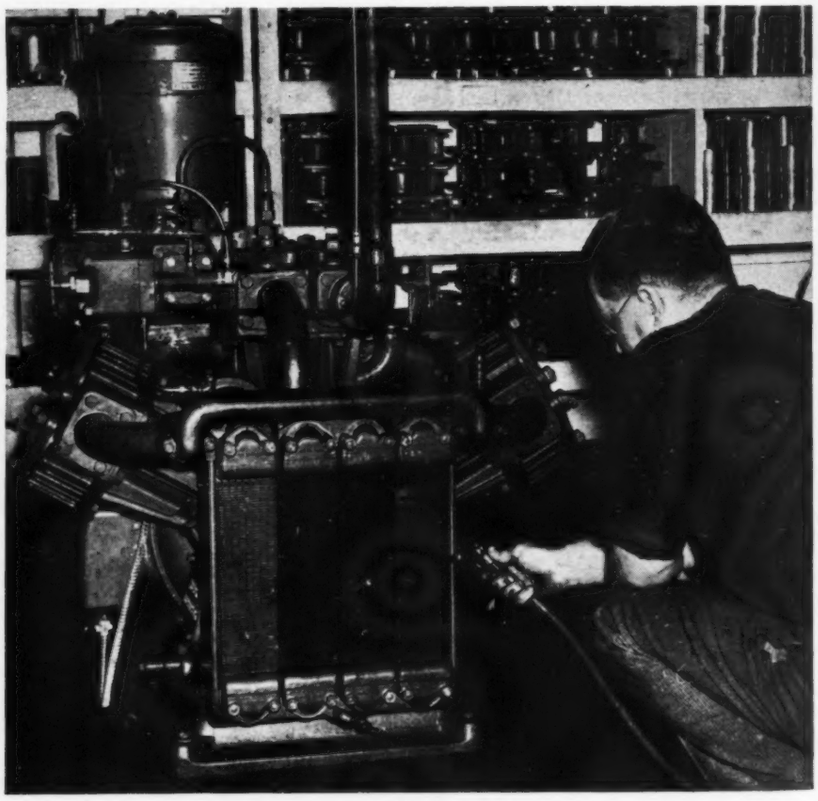
Smaller units are often air-cooled, with fan-type flywheels that circulate air over the finned cylinders and, in two-stage units, over finned or sectional intercoolers. The cooling fins will eventually get dirty and should frequently be blown out with high-pressure air jets.

One of the most common complaints with air-cooled units—overheating and consequent valve trouble—is usually not the fault of the compressor. Disregard of the fact that air circulation is essential, placing a compressor too close to walls or in a closed room, is one cause. The second is neglect of intercoolers, which must be kept clean and blown out.

With water-cooled units, it is of primary importance that the water be clean and non-scale-forming; it should not be too cold, the water outlet temperature preferably being maintained 15 degrees Fahrenheit or more above the air inlet temperature. This temperature range tends to prevent sweating and condensation on the cylinder walls. Water or other liquids cause more compressor cylinder wear than any other foreign material.

Multi-stage units have intercoolers, which reduce the air temperature between stages, thus also reducing power requirements. Intercoolers can efficiently use the coldest water available. In addition to keeping the air temperature lower, which results in better lubrication, less valve trouble, and lower power cost, the intercooler condenses some of the water vapor taken in with the intake air and prevents its being carried over into pipelines and tools. This condensate must be removed from the system periodically. Many large units have automatic traps to keep the cooler drained; smaller units use manual means. This drainage is an important point of operation, and cannot be overemphasized. Water going into the high-pressure cylinder results in rapid wear.

Since water in many localities lacks ideal qualities, wash and clean the jackets and cooler nests as needed. Inspect often enough to be sure that



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mud or scale does not blanket the heat transfer surface.

The valve is the heart of the compressor and takes the most severe treatment. It must open and close as many as 800 or more times a minute. It must be tight against pressure and must withstand high temperatures and repeated shock.

Soak Dirty Valves

Dirt from the intake air, which collects on inlet valves, is usually soft and can be washed off. Discharge valves often have a hard carbon formation, indicating poor oil, too much oil, or excessive temperatures. This dirt must be cleaned off periodically by removing the valves, soaking them in kerosene or similar solvent, and giving them a stiff brushing. (Be sure they are dry before replacing.) Scrape lightly where absolutely essential. Always inspect carefully for broken valve plates or springs. These must be replaced.

Do not take the valve apart unless it cannot be cleaned otherwise or unless it needs repair. If disassembly is required, note carefully the exact arrangement of the parts so that they may be reassembled in the same order. Never interchange parts between valve assemblies. Keep the same assembly together at all times (except for replacements).

Broken or leaky valves, or valve assemblies improperly seated in the cylinder, permit air to flow backward through the opening. This always results in overheating. Discharge valve leaks are particularly dangerous.

Leaky intake valves may be detected readily because the cover will feel warm. Discharge valve leaks can also be detected through excessive cover temperatures, but are not as obvious because all discharge valves are hot. The leaky ones get "hotter" and an experienced operator will soon detect those that need attention.

In a multi-stage compressor the intercooler pressures are excellent indicators of valve condition, but should not be absolutely depended upon. An intercooler pressure higher than normal usually indicates leakage in high-pressure valves, while low pressures show low-pressure cylinder valve trouble.

A satisfactory valve inspection program involves cleaning and checking at least half the valves in a unit each two to four weeks. Consult the instruction book for any special valve care needed.

Many compressors are belt-driven. Flat leather or V belts may be used. Correct tension is essential for efficient and long service. Too great tension overstrains the belts and is apt to result in worn or overheated motor and compressor bearings. Too little tension results in rapid belt wear and lost power through slippage.

Filters are a benefit only when serviced, kept clean, and in efficient working order. An air jet directed parallel to fins cleans a felt-type filter

A bearing should never be touched unless it is obviously out of proper adjustment. A bearing is considered here as the stationary part within or upon which another part rotates, slides, or otherwise moves. The two are kept from actual contact by a film of oil. Proper lubrication reduces wear in a bearing to an infinitesimal amount. Tighten the bearing too much and the oil film becomes too thin to prevent metallic contact, and the bearing will heat or seize. A loose bearing results in motion and pounding between the moving and fixed part, and wear takes place.

Study the manufacturers' instructions on bearing adjustments. Have adjustments made by a mechanic, but only when necessary.

Upon the regulation or control of the compressor falls the responsibility for maintaining the required air pressure. Most regulating devices are subject to adjustments but these must be carefully made. Study the instruction book which describes in detail the functioning of the control supplied with the compressor.

An automatic stop-and-start unit should have as wide a pressure range as can be allowed. It must be connected to sufficient receiver volume to prevent too-frequent starts. A limit of 12 per hour is set by some electrical manufacturers as the maximum for safe operation on motors and starters.

Controls must be set closer on "constant speed" compressors but should not function too often. Regulator should be checked to be sure it functions properly. Most designs permit manual operation for inspection purposes.

Variable speed controls are supplied on most steam and gas engine driven compressors. These usually incorporate a maximum speed device with overspeed protection, which should be checked occasionally to be sure it functions as intended.

Check Regulator Daily

Once a day is not too often to check regulator operation. It takes only a moment.

Safety devices serve a vital purpose on your compressor. Safety valves on the system should be blown manually every day and the pressure setting checked at least once a year. Pressure gages should be checked at least twice a year.

Overspeed trips, thermostatic controls of cooling water, and pressure controls should be checked frequently.

Safety, as well as proper care, demands that valves, cylinders, and cylinder jackets be kept clean to prevent excessive temperatures. Never use gasoline to clean air cylinders. Nonvolatile or non-explosive cleaners and solvents are best.

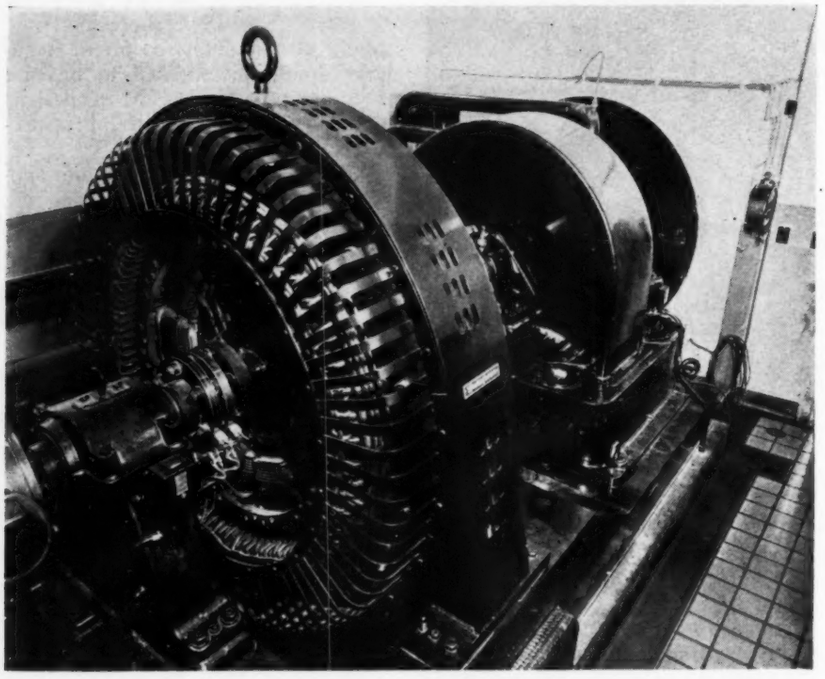
The compressor driver, be it electric motor, gas, oil, or steam engine, must be given due attention. We can only say "Follow manufacturers' instructions carefully."

The aftercooler is an important accessory and on its proper operation depends, to a considerable extent, the success of air use in a plant. Little difficulty will be encountered with an aftercooler if it is kept clean, particularly on the water side.

A regular maintenance job should be the inspection of automatic traps on intercooler, aftercooler, and receiver. Drainage of condensate is vital to the operation of compressors and to the use of compressed air. Traps are often discharged to sewers where it is impossible to determine whether or not they are functioning. This condition should be remedied and weekly inspection of their correct operation should be made.

MAINTENANCE SHORTS

Readers are invited to contribute brief articles, illustrated when possible, reporting out-of-the-ordinary maintenance accomplishments. Accepted articles will be paid for



One of sixteen similar synchronous generators driven by airplane engines on shake-down test runs. The power generated by these engines was formerly wasted, now is fed to a common bus and used to build still more engines

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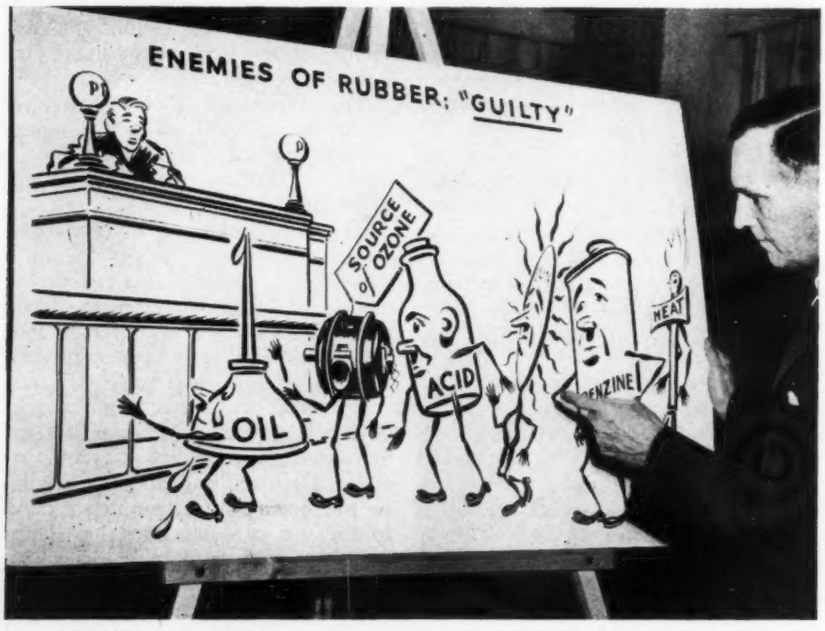


Enemies of rubber, guilty of sabotage, are vividly depicted on this poster designed by U. S. Rubber Company, New York, to impress employees with the importance of protecting rubber from oil, ozone, acid, sun, benzine, heat

Utilizes Power From Engines on Test

SOURCE—Westinghouse Electric & Manufacturing Company, East Pittsburgh

The new plant of a prominent airplane engine manufacturer uses even the "pig's squeal" in turning out its product. Engines for military aircraft are given a shake-down or green run of several hours under load. They are then torn down, inspected, and re-assembled for a final run, also under load. These tests consume millions of gallons of gasoline every month. In the past the engines wasted their power by driving special propellers. This method of testing created problems of noise and heat elimination.

Now, however, through installation of sixteen 1250-kva., 720-r.p.m., synchronous generators, the power developed in testing the engines is used to build them. Each generator is connected to an engine through a hydraulic slip coupling, arranged so that when the engine speed exceeds 720 r.p.m., the generator runs at constant speed and delivers power to the plant a.c. bus. The amount of power recovered is sufficient to supply a large percentage of that needed for engine manufacture.

•

A 3-in. layer of moving water on the roof of a new blackout plant is expected to assist in cooling the plant in summer, insulate it in winter, and extinguish incendiary bombs.

•

Saved Time by Machining Rotor Shaft in Place

SOURCE—General Electric Company

Methods used in performing a machining job necessary on the rotor of an old waterwheel generator may serve well in similar situations elsewhere. Loss of proper alignment of parts on vertical-shaft units of this type sometimes results in working of the thrust collar on the shaft. Flat spots on the shaft then usually develop from the movement between shaft and collar, making it necessary for the shaft to be trued up.

Because the rotor could not be removed without practically dismantling the station, a rig was built to grind the

Prescription for Victory!

Now's the time when a *Save to Win* policy is just what the doctor ordered. An ounce of prevention is better than a pound of cure, when you're caring for vital tools and equipment.

For instance, your long-lived, dependable Exide Batteries will last even longer if given reasonable, normal care. Follow these simple rules and *Save to Win.* That's good medicine for you, and bad medicine for the Axis.

MAKING BATTERIES LAST HELPS STOP THE AXIS!

1. Keep adding approved water at regular intervals. Most local water is safe. Ask us if yours is safe.
2. Keep the top of the battery and battery container clean and dry at all times. This will assure maximum protection of the inner parts.
3. Keep the battery fully charged—but avoid excessive over-charge. A storage battery will last longer when charged at its proper voltage.
4. Record water additions, voltage, and gravity readings. Don't trust your memory. Write down a complete record of your battery's life history. Compare readings.

If you wish more detailed information, or have a special battery problem, don't hesitate to write to Exide. We want you to get the long-life built into every Exide Battery. Ask for booklet Form 1982.

THE ELECTRIC STORAGE BATTERY CO., Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto

Exide
IRONCLAD
BATTERIES

shaft by rotating the grinder around it. This rig included an upper and lower guide, each with three adjustable brass blocks for centering and maintaining close running clearance. These guides were joined rigidly by two pieces of stiff channel iron and so spaced that they rode on smooth portions of the shaft, which were true. A compound toolrest was fastened on one of the channels to support a small motor-driven grinder with a 2-in. wheel operating at about 13,000 revolutions per minute.

A 20-in. wooden pulley was fastened to the lower guide and belted to a ½-hp., 148-r.p.m. gear motor with a small pulley, which drove the grinder around the shaft at approximately 14 revolutions per minute. The parallel feed of the toolrest was connected to a six-spoke starwheel below the wooden pulley and a stationary pin was located to turn the feed screw one

spoke for each revolution of the rig, thus providing automatic feed of the grinder up and down the shaft.

A collector ring from an old motor was mounted on top of the assembly to conduct power to the grinder.

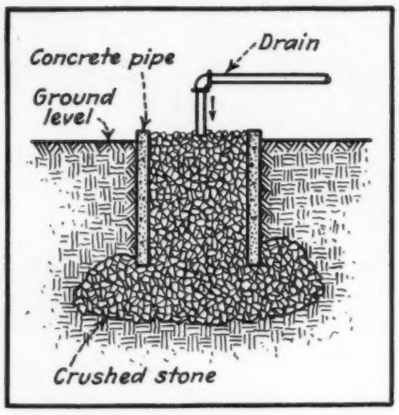
Two days of grinding were necessary to true the shaft satisfactorily. A pin gage was made for the new diameter, with allowance for the desired fit. The thrust block, with its bore built up by metal spraying, was ground out to fit this pin gage. The thrust block was then warmed to about 75 degrees Centigrade, which allowed the block to slide in place easily on the shaft.

•

Uses Catchbasin for Waste Water

S. H. COLEMAN, Roanoke, Va.

A cheap method of handling drips from steam traps draining outside steam lines and like uncontaminated wastes involving small quantities of liquid, when the waste



point is some distance from the nearest sewer or drainage main, is to provide a catch basin at the waste point. Such a basin should be filled with crushed stone or coarse gravel to allow the liquid to dissipate itself in sub-surface strata without appreciably affecting the soil at ground level. If the upper portion of the catch-basin is incased in a section of large-diameter terra cotta or concrete pipe, soil will be prevented from mixing with the coarse aggregate and practically all danger of saturating the surface soil will be eliminated.

•

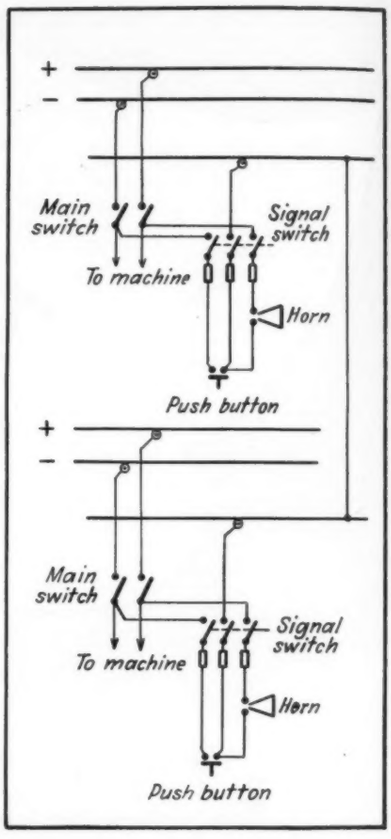
One-Wire Signal Between Machines

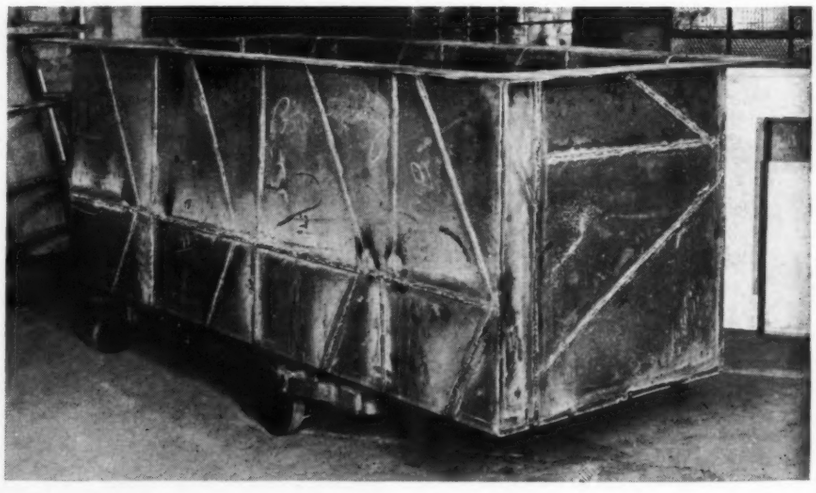
GILBERT LINDGREN, Electrical Foreman, Hudson Valley Fuel Corp., Troy, N. Y.

Recently the problem arose of providing a two-way audible signal system between two machines that move along parallel tracks some distance apart. It was desirable, of course, to make this system as simple and inexpensive as possible, consistent with reliability.

Accordingly the arrangement shown in the diagram was worked out. As will be noted, it requires only one additional trolley wire for each machine. The two trolleys are in turn connected together.

This scheme could, of course, be used between machines at any angle with each other.





When material shortages made it impossible for Union Steel Products Company, Albion, Mich., to buy plating tanks or the materials necessary to make them, the maintenance department welded two out of scrap steel gathered up in the plant. Fifty-six pieces of scrap went into this one

YOUR ROLLER BEARINGS HAVE A BIG JOB TO DO. DON'T NEGLECT THEM! KEEP THEM CLEAN . . . WELL LUBRICATED . . . PROPERLY ALIGNED! THIS IS NO TIME TO TAKE CHANCES!

WHILE anti-friction bearings keep factory wheels turning, transportation rolling and farm machinery producing, they have the added wartime job of keeping armies on the go, aircraft aloft and battle fleets afloat.

Vital to the arming, transporting and feeding of our forces . . . with Victory demanding round the clock operation, day after day . . . even sturdy bearings like Hyatts, *which run for long periods without attention under normal conditions,* need a little care today.

Be sure bearings are properly sealed and lubricated. Be sure bearings fit snugly...for looseness might cause excessive wear and misalignment. Keep bearings free from grit and dirt both in assembly and in operation.

With Hyatts assigned to two important jobs: beating friction and helping to beat the Axis...don't neglect them! Our Engineering Department will be glad to help you on any bearing application or maintenance problem.

Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.

THIS IS THE 50TH YEAR OF HYATT ROLLER BEARINGS

Trouble-Shooting Sound Systems

HARRY PARO, Chief Sound Engineer, Lafayette Radio Corporation, New York

HERE IS A CHECK-LIST of troubles encountered in industrial sound systems with logical steps in the location of and remedy for each. This check-list applies directly to industrial call systems, but is equally applicable to other types of industrial sound systems. They are all basically similar, because all employ an amplifier fed by some form of input device and working into a loudspeaker system.

In many instances, service interruptions or irregularities are caused by unauthorized persons tampering with the control knobs on the amplifier. It is wise, therefore, to check all these controls first, to see that each is adjusted to its normal position. Further trouble-shooting will be aided by the specific suggestions presented below.

1. One Loudspeaker Silent

Possible causes:

Defective loudspeaker.
Break or short in associated wiring.
Faulty contact in associated plugs or receptacles.
Field coil not energized (if loudspeaker is of the electro-dynamic type).

Locating source of trouble:

Substitute spare loudspeaker.
"Ring out" wiring circuit, including connectors, or check with ohmmeter.
Test field coil with voltmeter to insure presence of d.c. exciting voltage

Remedy:

When source of trouble is located, its remedy will be self-evident.

2. Several Loudspeakers Silent

Possible causes:

Break or short in associated wiring.
Faulty contact in associated plugs or receptacles.
Field coil not energized (if loudspeaker is of the electro-dynamic type).
If more than one matching transformer is used in wiring lines, the one feeding silent group of speakers may have developed defect.

Locating source of trouble:

Same as No. 1, except that the loudspeakers should be disconnected from the line one at a time to determine whether a short-circuit in one may be affecting others on the same wiring circuit.
Check group-matching transformer for open or short-circuit.

Remedy:

When source of trouble is located, the remedy will be self-evident.

3. All Loudspeakers Silent

Possible causes:

Fuse in power-supply line or amplifier burned out.
Defective tube in amplifier.
Defective microphone or microphone wiring.
Defect in main loudspeaker line or matching transformer.
Faulty contact at microphone or amplifier connections.
Breakdown in amplifier.
Defective loudspeaker shorting entire output system.

Locating source of trouble:

Inspect tubes to see that all are lighted. If all out, check fuse.
Inspect amplifier controls to see that all are properly set.
Follow proceeding for isolating cause of general breakdown by process of elimination. (FACTORY, April 1942, page 64.) Test in detail whatever part of system shows defect.
Disconnect loudspeakers one at a time to determine where one may be short-circuiting line.

Remedy:

If trouble is in wiring circuits, repair.
If it is in microphone, transformer, or loudspeaker, replace.
If it is in amplifier, test all tubes in the tube tester or replace the tubes one at a time with exact duplicates. Test input and output connectors of amplifier for good contacts. If these steps do not correct trouble, have amplifier checked and repaired by manufacturer, supplier, or local amplifier service man.
If trouble is located in a loudspeaker, replace the defective one with spare.

4. Low Volume

Possible causes:

Improper adjustment of amplifier controls.
Operator too far from microphone.
Partial short-circuit in wiring system.
Defective tube.
Defect in microphone, amplifier, loudspeaker system, wiring, or connectors.
Loudspeaker field coils not energized.
Oscillation in amplifier.

Locating source of trouble:

Same procedure as for No. 3, except that fuses need not be checked and other tests will be for partial rather than total breakdown.
Check field supply voltage to loudspeakers (if all have their fields energized from an external field-supply unit).
Check for amplifier oscillation by connecting neon bulb across amplifier output terminals with system in normal operation but no speech into microphone. If bulb lights, oscillation is indicated. If amplifier output is of low impedance (under about 50 ohms) it will be necessary to employ an output meter (a.c. type suitable for measurement of high audio frequencies, or even frequencies above audibility), or to connect the neon bulb through a suitable step-up transformer.
If system is found to be oscillating, check for cause. Make sure that amplifier is properly grounded and ground connection is free from corrosion. If new microphone or loudspeaker wiring has been added to system, this is to be suspected. Cut out this portion to see

(*Continued on page 138*)

Types, Sizes and Weights for Every Pipe Welding Need

TUBE-TURN
WELDING FITTINGS

180° SHORT RADIUS RETURN

180° LONG RADIUS RETURN

REDUCING OUTLET TEE

STRAIGHT TEE

45° LONG RADIUS ELBOW

90° SHORT RADIUS ELBOW

90° LONG RADIUS ELBOW

180° EXTRA LONG RADIUS

STRAIGHT LATERAL

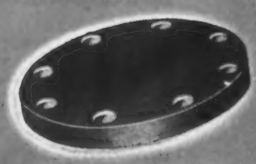
WELDING RING

ECCENTRIC REDUCER

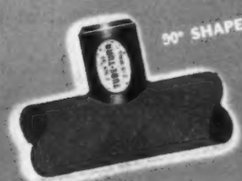
CONCENTRIC REDUCER

LAP JOINT STUB END

CAP


BLIND FLANGE

45° SHAPED NIPPLE



90° SHAPED NIPPLE

STRAIGHT CROSS

SADDLE

SLIP-ON FLANGE

WELDING NECK FLANGE

SCREWED FLANGE

LAPPED FLANGE

TUBE-TURN WELDING FITTINGS—RANGE OF SIZES

TYPE OF FITTING	DESCRIPTION	STANDARD WEIGHT	EXTRA STRONG	SCHEDULE 160	DOUBLE EXTRA STRONG
ELBOWS	90° LONG RADIUS	½"-24"	¾"-24"	1"-12"	1"-8"
ELBOWS	90° SHORT RADIUS	1"-24"	1½"-24"		
ELBOWS	45° LONG RADIUS	½"-24"	¾"-24"	1"-12"	1"-8"
RETURNS	180° LONG RADIUS	½"-24"	1"-24"	1"-12"	3"-8"
RETURNS	180° SHORT RADIUS	1"-24"	1½"-24"		
RETURNS	180° EXTRA LONG RADIUS	1"-2½"	1"-2½"		
TEES	STRAIGHT	¾"-24"	¾"-24"	1"-12"	1"-8"
TEES	REDUCING OUTLET	¾"-24"	¾"-24"	1"-12"	1"-8"
REDUCERS	Concentric and Eccentric	1x⅜"-24x20"	1x⅜"-24x20"		1x⅜"-12x10"
CAPS		1"-24"	1"-24"		1"-24"
STUB ENDS	LAP JOINT	1"-24"	1"-24"		
NIPPLES	Shaped, 90° or 45° to Header	1¼"-12"	1¼"-12"		
SADDLES		2"-24"			
LATERALS		1¼"-24"	1¼"-24"		
CROSSES		1¼"-24"	1¼"-24"		
RINGS		¾"-12"	1¼"-12"		
		150, 300, 400†, 600 and 900* Lb.		1500 Lb.	2500 Lb.
FLANGES	WELDING NECK	½"-24"		½"-24"	½"-12"
FLANGES	SLIP-ON	½"-24"		½"-12"	½"-12"
FLANGES	LAP JOINT	½"-24"		½"-24"	½"-12"
FLANGES	THREADED	½"-24"		½"-12"	½"-12"
FLANGES	BLIND	½"-24"		½"-24"	½"-12"

† Dimensions on sizes thru 3½" same as for 600 lb. flanges.

* Dimension on sizes thru 2½" same as for 1500 lb. flanges.

For sizes of light gauge and super-weight fittings, forged steel flanges, and for complete specifications on all Tube-Turn fittings, refer to *Tube-Turn Catalog.*

TUBE-TURN TRADE MARK *Welding Fittings*

The ★ FIRST WELDING FITTINGS 1ST AND STILL THE BEST

TUBE TURNS, INC., LOUISVILLE, KY. *Branch offices:* New York, Chicago, Philadelphia, Pittsburgh, Cleveland, Tulsa, Houston, Los Angeles, Washington, D. C. *Distributors in all principal cities.*

Trouble-Shooting Sound Systems (*Continued from page 136*)

if oscillation stops. If so, the trouble will likely be found in feedback caused by running this wiring too close and parallel with existing wiring, thus permitting feedback from output to input circuits.

Remedy:

Same as for No. 3. If oscillation is due to feedback in wiring system, separate offending circuits or provide more adequate electrical shielding. If due to other causes, location of source will suggest remedy.

5. Raspy Reproduction or Rattling at One Loudspeaker

Possible causes:

Defective loudspeaker or loudspeaker out of adjustment.

Defect in transformer contained in this loudspeaker.

Locating source of trouble:

Replace with spare duplicate loudspeaker.

Remedy:

Replacement. Return defective unit to manufacturer or supplier for repair.

6. Raspy or Distorted Reproduction From All Loudspeakers

Possible causes:

Improper adjustment of amplifier controls.

Defective tube.

Defective line-matching transformer.

Defect in microphone.

Failure of some component in amplifier.

Locating source of trouble:

Check adjustment of amplifier controls, particularly tone control and treble control.

Disconnect loudspeaker system from amplifier and connect spare loudspeaker direct to amplifier (be sure proper impedance match is obtained). If trouble is still present its source lies in amplifier or microphone. If trouble is eliminated, fault is probably in the loudspeaker line-match transformer.

Test all tubes.

Substitute another microphone.

If none of these locates the condition, it is an indication that the trouble is in the amplifier, and a detailed check-up can be made by supplier or local service man.

7. Howling or Whistling

Possible causes:

Defective tube.

Break in microphone connections or wiring.

Improper adjustment of amplifier controls.

Operator speaking too far from microphone with attendant necessity for operating amplifier with microphone or volume controls turned too high.

Poor ground connection from amplifier.

Failure of some component in the amplifier.

Some loudspeaker feeding back into microphone.

Microphone circuit grounded other than at its amplifier terminal.

Locating source of trouble:

Check adjustment of amplifier controls, particularly the tone or treble controls.

Check distance of operator from microphone. If more than few inches, move microphone closer or instruct operator to talk closer.

Check microphone wiring, extension cable, and connectors for break.

Disconnect loudspeakers nearest the microphone, one at a time, to determine whether one is feeding back.

Check ground connection to amplifier.

Check microphone and its wiring to make sure they have not developed grounds at any point other than the intended one at amplifier.

Test tubes in tube tester. Also test while in operation by tapping gently.

If tapping any one tube aggravates the howling this tube is microphonic and should be replaced.

Check for oscillation in amplifier.

Have amplifier checked for defective component.

Remedy:

When above checks have located trouble, remedy will be self-evident.

Where feedback is the cause, either reduce volume at offending loudspeaker or turn it so that its output will not be directed or reflected toward microphone. Feedback will seldom develop after a system has been operating successfully. If it does it is usually the result of the position of either the microphone or a loudspeaker being changed, leaving open a door which normally helps to isolate microphone location from that of the loudspeaker.

8. Loud Hum Heard Through Loudspeakers

Possible causes:

Defective tube.

Defect in microphone.

Open circuit in microphone wiring or connectors.

Improper adjustment of amplifier controls.

Broken ground connection.

Failure of some component in amplifier.

Electrical disturbances from arcing brushes of motors, and picked up by microphone wiring.

Locating source of trouble:

Disconnect microphone wiring from amplifier. If hum persists when volume control is in normal position, the trouble has its source in the amplifier.

If this stops the hum, its source is obviously in the microphone or its wiring, and they should be checked in detail for opens, unintended grounds, and for proper grounding at amplifier.

If these points are okay, check to see whether any new electrical equipment (or its wiring) has been installed near the microphone or microphone wiring; or whether such existing equipment may have developed arcing.

If trouble is in amplifier, check positions of controls and test tubes. If these are not at fault, have amplifier tested internally for failure of some component.

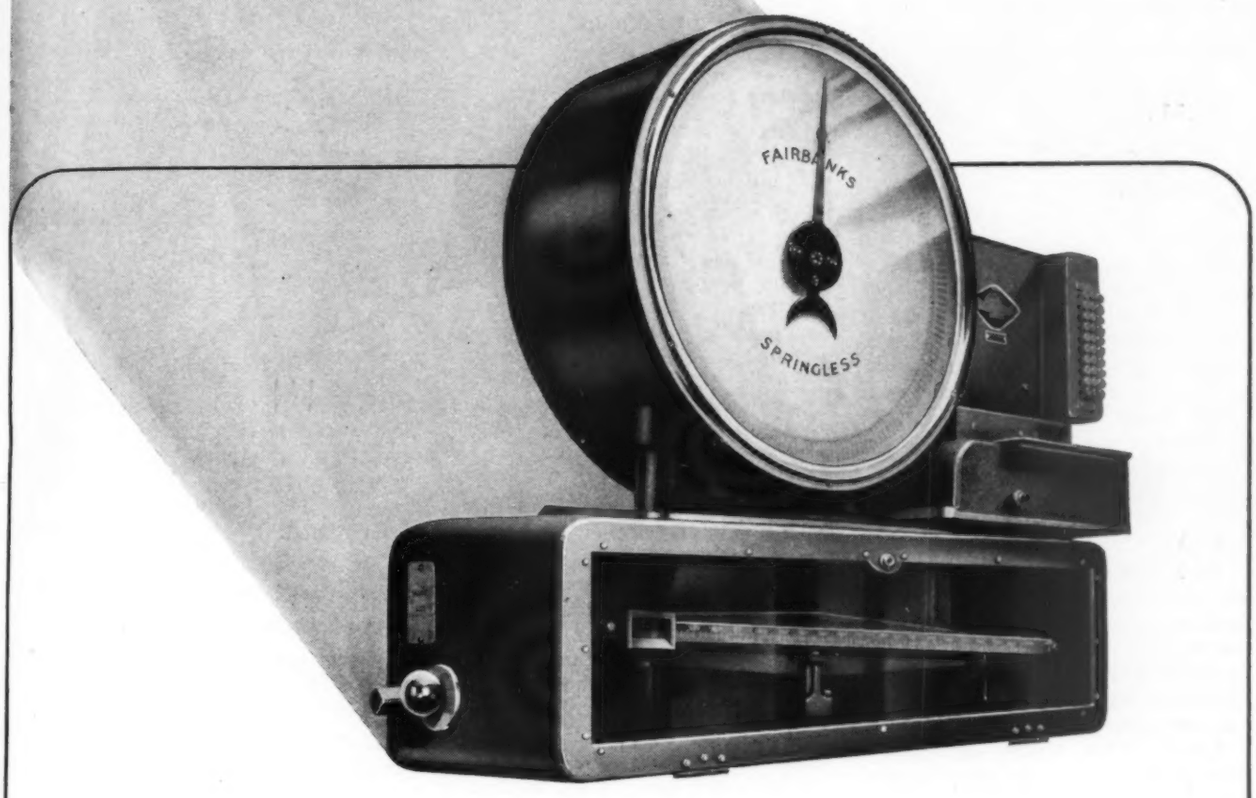
Ascertain whether electric fan or mechanical equipment near microphone may be causing mechanical vibration of microphone.

Remedy:

Location of trouble in microphone circuits or amplifier will immediately suggest its own correction.

(*Continued on page 140*)

THESE SCALES HELP UPSET THE AXIS TIMETABLE!



THE speed and accuracy of modern Fairbanks Scales, and their many ingenious applications, are helping rush war matériel production.

Use your priority to get Fairbanks weighing equipment that will not only save precious minutes now but also serve you best in years to come.

Fairbanks scale engineers are ready to help you plan for today with an eye for tomorrow. Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago.

FAIRBANKS-MORSE

SCALES
DIESELS
MOTORS
PUMPS

Trouble-Shooting Sound Systems (*Continued from page 138*)

Trouble from arcing brushes may be corrected by repairing offending equipment or by use of interference filter.

9. Irregular Popping or Frying Noises

Possible causes:

Defective tube.
Partial break or short-circuit in microphone or loudspeaker wiring.
Nearby mechanical noise picked up by microphone.
Electrical disturbance picked up by microphone wiring.
Partial short- or open-circuits in any part of wiring system, microphone, line-matching transformers, loudspeaker, etc.
Poor ground connection, either at point where amplifier is grounded or at point where microphone system is grounded to amplifier.
Defect in amplifier.
Defect in microphone.

Locating source of trouble:

Same as No. 8 except that this trouble may have its source in the loudspeaker system or wiring as well as in microphone circuits and amplifier; also in partial rather than complete short-circuits or breaks in wiring or individual components.

Check entire system for general breakdown to isolate the offending portion by the process of elimination. Then check this portion in detail.

Remedy:

Location of trouble source will suggest its own correction.

If in amplifier, replace any defective tubes. If this does not correct, then have amplifier tested and repaired by qualified expert.

If in microphone, a loudspeaker, matching transformer, or other component, replace offending item.

10. High-Pitched, Unnatural Reproduction at All Loudspeakers

Possible causes:

Improper adjustment of amplifier controls, particularly tone, bass, and treble controls.

Break or short-circuit somewhere in loudspeakers or loudspeaker wiring system.
Microphone deteriorating but not entirely dead.
Poor ground connection.
Oscillation in amplifier at a frequency above audibility.
Failure of some component in amplifier.

Locating source of trouble:

Check adjustment of amplifier control. If amplifier has microphone controls not in use, see that they are all the way off.

Disconnect loudspeaker system from amplifier and connect spare loudspeaker direct to amplifier, properly matching its impedance. If trouble disappears, its source is a loudspeaker, matching transformer, or the wiring.

Check wiring for open or short. Check for bad speaker by disconnecting one at a time, listening at others to note whether correction occurs.

Matching transformers are difficult to check for partial defects and this is a job that can best be left to an expert.

If substitution of a single loudspeaker for entire loudspeaker system fails to correct trouble, eliminate microphone wiring by connecting microphone direct to amplifier. If this corrects trouble, check this wiring in detail for open- or short-circuits. If it does not correct, substitute another microphone.

Check amplifier ground, tubes, and connectors. If these are okay, have amplifier checked internally.

Check for amplifier oscillation, as No. 4.

Remedy:

Location of trouble source will suggest own correction.

11. Tube Life Abnormally Short (not necessarily accompanied by burnout of filaments)

Possible causes:

Excessive line voltage or surges.
Improper fuses.
Defect or failure in amplifier wiring or components.
Adding loudspeakers without providing for altered impedance match to amplifier output. This will result in incorrect loading for power tubes and may damage these tubes.

Locating source of trouble:

Check fuse values against amplifier manufacturer's specifications.
Check line voltage, over extended period if necessary, to detect occasional surges.
Check current drawn by amplifier and compare with manufacturer's rating for this unit.
Check output connections of amplifier for proper match to loudspeaker load (necessary only if loudspeakers have been added or taken out).

Remedy:

Install proper fuses in amplifier and line.
If line voltage is at fault, arrange for correction by tapping off another line, etc.
If amplifier is drawing excessive current, have it checked to determine cause and correction.
Select proper amplifier output connections, if the loudspeaker system has been altered.

12. Conversation or Noise Reproduced by Loudspeakers

Possible causes:

Microphone located in noisy surroundings.
Microphone gain turned too high at amplifier.
Operator speaks too far from microphone.

Locating source of trouble:

Check location of microphone in respect to surrounding noise.
Place microphone closer to operator and instruct operator to speak within a few inches of it.
Determine the proper adjustment of amplifier controls to exclude background noise.

Remedy:

Eliminate excessive noise if possible.
Move microphone away from noise if this is convenient.
Adjust amplifier volume to a lower level to exclude noise.
Instruct operator to talk closer to microphone so that this reduced level of amplification will be adequate for reproduction of the voice.

THE MISSING MAN

Every day, illness costs America the work of a million men!

AMERICAN industry loses *a full week's work* every year because of illness, it is indicated in reports of the U. S. Public Health Service. Over half of this lost time is due to common colds and their complications, other authorities state.

According to the Industrial Health Practices survey of the National Association of Manufacturers, absences were cut 29.7% in companies which established health programs. Individual tissue towels, soap and hot water help prevent the spread of illness.

Perhaps you are already giving your employees the protection of ScotTissue Towels. In this case, urge them to prevent the waste of towels . . . so that more workers can enjoy their advantages. We'll be glad to assist in such a conservation program.

Join the Scott WAR ON WASTE

The Scott Washroom Advisory Service can offer many practical suggestions for reducing towel waste. For example, our colorful posters remind workers that *one* towel will do the job.

In fact, a "Soft-Tuff" towel can absorb twice the amount of water normally left on hands after washing. And it has ten times more rub strength than previous ScotTissue towels.

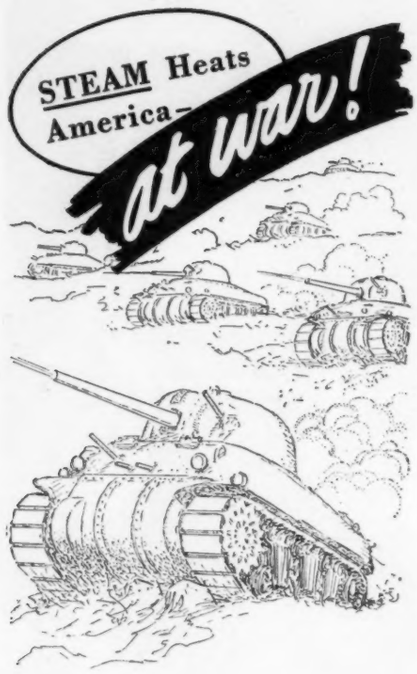
Savings up to 30% have already been made in certain industries.

For complete details of this service, write Scott Paper Co., Chester, Pa.

"SOFT-TUFF" **Scot Tissue** TOWELS

Stay Tough When Wet

Trade Marks "ScotTissue," "Soft-Tuff," "Washroom Advisory Service" Reg. U. S. Pat. Off.



SWIFT, hard-hitting tanks . . .

45 thousand in 1942 . . .

75 thousand in 1943 . . .

That is America's promise to the Victory Program—and America is going to beat that promise.

It calls for construction miracles . . . huge plants to house vast assembly lines . . . new plants for principal parts suppliers.

As America builds for Victory, every cubic foot of space must be properly heated to insure maximum production.

For fifty years, steam has been recognized as the outstanding heating medium. Steam, harnessed and brought under control with Webster Steam Heating Equipment, has proved its ability to provide maximum comfort, economy and trouble-free operation.

Today, all of our facilities not required for direct war work are freely offered to architects, engineers and heating contractors working on war construction.

Essential repairs for Webster Systems are available on A-10 priority, under W.P.B. Emergency Repair Order P-84. Orders should be limited to actual needs.

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Webster
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YOU WANT TO KNOW

more about the items mentioned on this page

Letters to the addresses given will bring information

• PROTECTIVE WALL of lightweight concrete blocks filled with sand is said to stop .30-caliber military rifle and machine gun fire shot from a distance of 10 feet or more. Replacing sandbag barricades, which deteriorate rapidly, the block walls form sabotage and bomb-splinter protection around power transformers, substations, and other vulnerable industrial equipment. The Celotex Corp., 919 North Michigan Ave., Chicago.

BOMB SNATCHER picks up a burning bomb and holds it so that molten metal will not spill. Handles thermite incendiary bombs and is effective in snuffing out magnesium bombs. If bomb is of the explosive incendiary type, upper section opens to relieve pressure of explosion. McGraw Electric Co., 5201 West 65th St., Chicago.

• PROBLEMS that come up in packaging dehydrated foods are discussed from all angles in a pamphlet made available by the American Management Association, 330 West 42nd St., New York.

• LATEST THING in shovels is a bomb shovel for putting out incendiary bombs, oil and magnesium fires. Its hollow handle holds a supply of sand ready for instant use. Los Angeles Shipping & Drydock Co., San Pedro, Calif.

• DIGEST of the fundamental principles involved in priorities and preference ratings is obtainable from Manning, Maxwell & Moore, Inc., Bridgeport, Conn.

• PROCESS for plasticizing and compounding Saflex, Monsanto Chemical Company's plastic for safety glass, so that it can substitute for natural rubber when applied to fabric by conventional "rubberizing" methods, is announced by Joseph L. Haas, Technical Director and Fabric Superintendent, Hodgman Rubber Co., Framingham, Mass. Has already been used for Army raincoats, life preserver jackets, and other equipment, it is said. Process and materials are available to interested manufacturers.

• TO HELP KEEP the tools of war industries in full operation Westinghouse Electric & Manufacturing Co., East Pittsburgh, Department 7-N-20, has made available a two-volume set of maintenance rules and suggestions for maintenance men responsible for the care of electrical apparatus in industry.

• FIREPROOF and skid-preventing oil absorbent, a granular substance developed to soak up oil accumulations from floors, has been made available by Waverly Petroleum Products Co., 478 Drexel Building, Philadelphia.

METAL CHILLING at sub-zero temperatures is made possible by this unit operating at 40 to 120 degrees below zero. Valuable in the tempering and hardening of high-speed tool steel to produce cutting tools with high strength and ductility. Motor Products Corp., North Chicago, Ill.

• TRANSPARENCY of a temporary coating that protects metal and ceramic parts against rust, surface scratches, grease, and dirt, permits visual inspection of the parts so protected. Applicable to highly polished surfaces, it is sprayed, brushed, dipped, or roller coated, and is easily removed. Ault & Wiborg Corp., 75 Varick St., New York.

• SAFETY FILM, "We're on the Spot," points out accident hazards that might crop up in war production plants, e.g., dirty and congested floors, improper use and care of tools, careless use of machine guards and safety equipment. It

Time-Outs GO ON QUARTER RATIONS

Compressor "down time" reduced 75% *with* SOLNUS OILS

War schedules for die castings don't allow for time-outs . . . and a shutdown of air compressors in a large plant certainly crippled production. But a Sun Engineer — one of the Doctors of Industry — had the answer with Solnus Oils.

Formerly compressors supplying high pressure air for operating die casting machines were shut down every three months due to carbon and gum formation. Now these same compressors, lubricated with Solnus Oils, have been in operation four times as long and are still going strong. Carbon and gum trouble have been stopped.

Results! To date time-outs have been placed on quarter rations and may be reduced even more. Production of vitally needed die castings for aircraft precision instruments and other war necessities is uninterrupted.

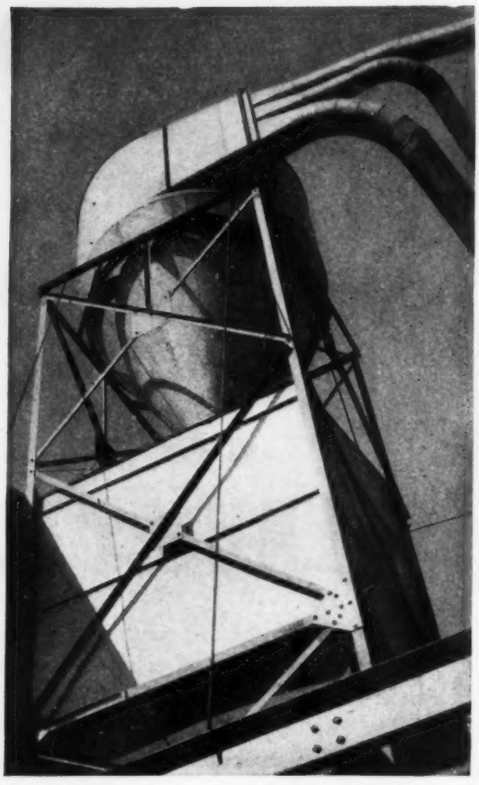
Remember whenever or whatever your problem involving petroleum products Sun's Doctors of Industry stand ready . . . willing . . . and able to help you improve your production. Let them show you the value of applying the right petroleum product in the right place. Write . . .

SUN OIL COMPANY — Philadelphia

Sponsors of Sunoco News Voice of the Air — Lowell Thomas

SUNOCO

SUN PETROLEUM PRODUCTS.. HELPING INDUSTRY HELP AMERICA



KIRK & BLUM

DUST CONTROL SYSTEMS *help industry maintain peak production*

Now more than ever must industry be free of all shackles—especially dust-laden air. Nothing must interfere with the effort for greater production.

That's why a large war production plant producing machine tools recently installed this Kirk & Blum Dust Control System in its enlarged pattern shop.

This entire new system, to clear the air of dust and collect shavings, was installed without interfering with machinery set-up and without loss of production time.

An interesting feature of this installation is the location of the shavings and sawdust storage bin between two buildings to permit truck passage for gravity loading.

Kirk & Blum Dust Control Systems are doing similar jobs—effectively and economically—in many war and civilian industries. Men, machines and materials are protected from dust. Working conditions are improved and costs are reduced.

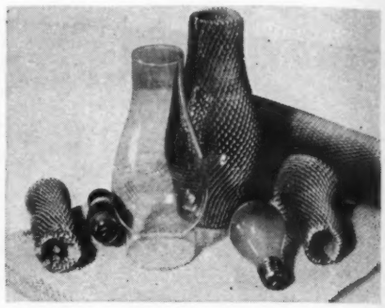
Why not consult Kirk & Blum Engineering Staff today? A survey of your plant can be made to determine how you, too, can maintain peak production.

Send for any of the following booklets:

"Blower Systems for Woodworking Plants"
"Dust Collecting Systems in Metal Industries"
"Fan Systems for Various Industries"
"Industrial Ovens"
"Cooling Systems for the Glass Industry"
"Data on Kirk & Blum Production Facilities"

THE KIRK & BLUM MANUFACTURING CO.
2835 SPRING GROVE AVE., CINCINNATI, OHIO

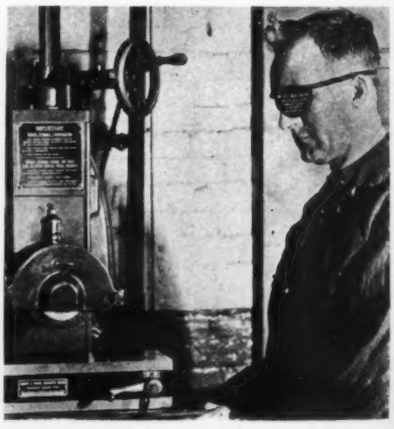
emphasizes importance of cleanliness and first aid and shows how closely associated are industry and the armed forces in this war. Available in 16-mm. sound and silent, and 35-mm. slide film with record. King Cole's Sound Service, Inc., 203 East 26th St., New York.



SHIPPING DEPARTMENTS will find a resilient packing material of kraft stock useful in cushioning delicate products against shock. It expands into a honeycomb pattern to conform to the curvature of any object. Is furnished in rolls and pads. Research Products Corp., Madison, Wis.

• PUNCH tabulating cards right on the spot where records originate and so save time and simplify punched-card accounting, advises Remington Rand Inc., Buffalo, makers of a handy punch always ready for use because you can carry it around with you.

• DO'S AND DON'T'S of lathe operations are set forth in a manual designed to help beginners understand the modern metal-cutting lathe, its parts and their functions, care and set-up, methods of holding the work, and performance of basic operations. 50c. Sheldon Machine Co., Inc., Chicago.



"MY EYE WAS HERE, I should have worn American safety goggles," reads the message on the eyepatch. American Optical Co., Southbridge, Mass., designed the patches for safety directors to pass out to workers to impress on them how it feels to have only one eye and so increase use of safety devices.

Here's why you can expect more satisfactory removal of unwanted solids (abrasives, contamination) by specifying

CUNO AUTO-KLEAN FILTERS

1. Cleanable (manually or automatically) without interrupting fluid flow. 2. Non-collapsible, all-metal construction. 3. Minimum pressure drop. 4. Permanent filter element — no cartridge to replace. 5. Obviates duplex installation. 6. Cleaned by *combing*, not scraping. 7. Minimum filter maintenance.

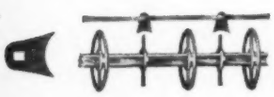
Made of any machinable metal in a wide range of sizes — small compact units up to massive motor-driven models — to handle fluid, air, gas.

HERE'S THE FILTER CONSTRUCTION THAT KEEPS FLUIDS FLOWING

1 This is one of a stack of *discs*, held apart by

2 *Spacers*, whose thickness determines the degree of filtration.

3 Discs and spacers are mounted on a *central rotatable shaft* which has a handle.



4 Mounted on a stationary rod alongside the shaft are *cleaner blades*, slightly thinner than spacers, extending into the slots between the discs and held apart by cleaner blade spacers.

5 Fluid containing solids passes between discs, and solids larger than the aperture are retained on the outer edges.

6 Turning the handle rotates the discs past the stationary cleaner blades, combing out accumulated solids, which fall into the sump, to be drained when convenient.

KEEP FLOW ON "GO" WITH

CUNO

THE "FILTER-FINE" STRAINER

50 MORE SERVICES PROTECTED BY CUNO

Acids
Adhesives
Air
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Animal Oils
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Coolants
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Dip Tank Systems
Enamel
Engine Fuel
Engine Lubricating Oil
Fuel Oil
Fuel Tar
Gases
Gasoline
Grease
Grinder Coolant
Hydraulic Oil
Ink
Japan
Lacquer
Lubricating Oil
Machine Tool Cutting Oil
Machine Tool Hydraulic Oil
Machine Tool Lubricating Oil
Nitrocellulose Solutions
Oils
Paint
Palm Oil
Paste
Pyroxylin
Quenching Oil
Resins
Rust Proofing Compounds
Sizing
Solvents
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Tar
Test Stand Lubricating Oil
Varnish
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Washing Compounds
Water
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Tiny models... huge models... described in "Quick Facts". It's free—send coupon.

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Please send free copy of "Quick Facts" to—

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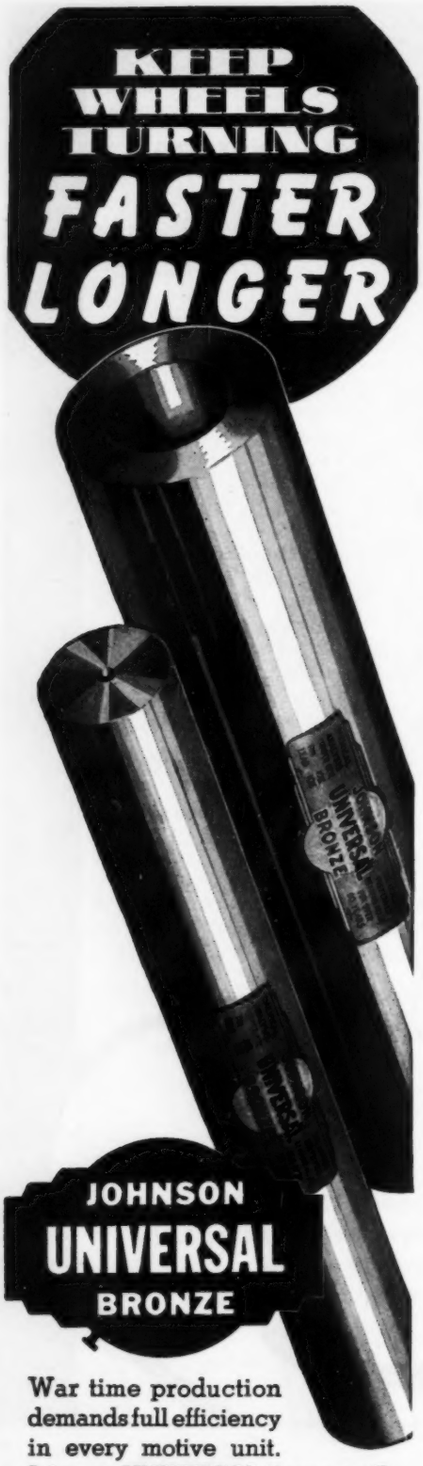


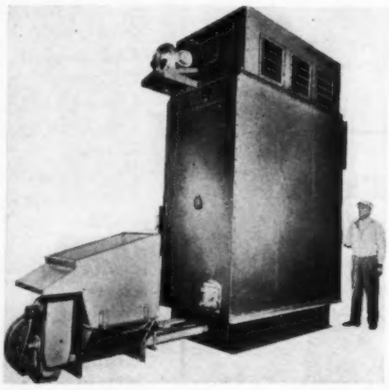
War time production demands full efficiency in every motive unit. Johnson UNIVERSAL Bronze will help you get the most from your bearings... cut replacements to a minimum . . . keep wheels turning FASTER . . . LONGER. Your local distributor carries a complete stock.

JOHNSON BRONZE
512 SOUTH MILL STREET
NEW CASTLE, PA.

WHAT'S NEW IN EQUIPMENT

Coal Fired Unit Heater

A direct-fired coal-burning unit heater equipped with an under-feed stoker of either bituminous or anthracite type and hopper or bin feed is announced. It also is available for hand firing with under-grate



4,000,000 B.t.u. output per hour. Unit fan. Made in eight sizes, from 750,000 to is self-contained having its own combustion chamber and distributing warm air either directly from outlet vents or through a simple duct system. Tightly welded combustion chamber prevents the infiltration of excess air.

Furnace temperatures are kept down because practically three-quarters of the heat recovered is by means of radiation into the upper part of the combustion chamber.

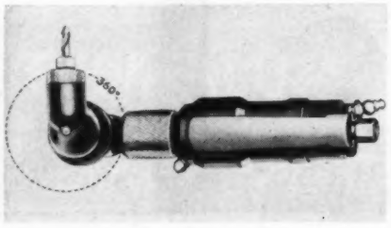
Unit may be installed during construction and used for temporary heat, or retained as a permanent system. Dravo Corp., Pittsburgh.

Chemical Resisting Paint

Paint able to withstand caustic liquors of 70 percent concentration or more, as well as vinegar and glacial acetic acid, is called Rust Eater 66. The makers claim it is practically inert to these chemicals. Harrington Paint Co., Inc., 1630 Collamer Ave., E. Cleveland.

Multiple-Angle Drill

A drilling head that can be set at any angle through 360 deg., fulfills the function of several angle drills. The head swivels in two planes. It can be turned



to any position relative to the location of the throttle lever. The fingers of the operator, close to the point of application, increase the accuracy of handling, and insure more speed in changing position. Weighs 2½ pounds, and is about 8 inches long when set for drilling in the direction parallel to the center line. Chuck is for ¼-in. drill. Speed of the No. 9D010 is 1000 r.p.m.; of the No. 9D020, 2000 r.p.m. The Cleveland Pneumatic Tool Co., 3744 E. 78th St., Cleveland.

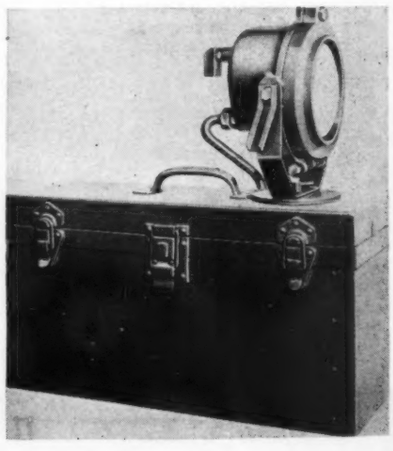
Cutting Compound

A paste cutting compound for power saws takes the place of soluble and cutting oils, and is known as D.C. paste cutting compound for power saws. It has a spreading and adhesive action which maintains a film on the surface of the blades, according to the manufacturers. It gives faster, cleaner cutting and does not become rancid. D. C. Cooper Co., 20 East 18th St., Chicago.

Portable Floodlight

Portable battery-operated floodlight for combustible areas which cannot have installed lighting has been announced. For use in powder igloo interiors, powder magazines, freightcar and warehouse interiors containing combustibles, and during blackouts and other emergencies.

Consists of a small steel box, 19x9⅞x20¾ inches, with a dust- and vapor-proof lamp

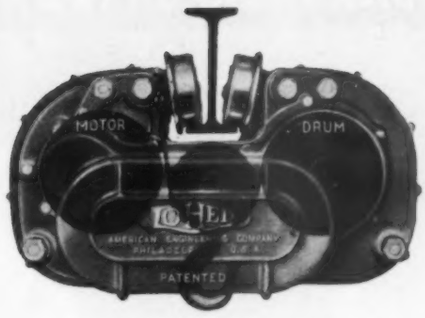


housing on a bracket to allow pointing in any direction. A high-efficiency glass reflector, combined with pre-focus positioning of the unit's 50-candle-power concentrated-filament type bulb and a diffusive lens, gives medium-angle floodlighting distribution.

A 5-cell storage battery with nonspill valves is housed in the box. Exchange of discharged for charged batteries is possible through a polarized connector per-

THIS TAKES

Balance

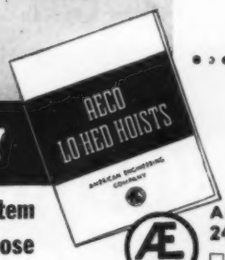


It took BALANCE to create this electric hoist

In a hoist, balance is mighty important for good operation. The Lo-Hed hoist was the first to achieve balance in a new way. It was the first hoist designed around the supporting beam . . . first to place motor and drum on opposite sides of and parallel to the beam . . . first to draw the hook up close to the beam . . . first to use a straight-line all spur gear drive. Time and time again, Lo-Hed has been called the "most logically designed hoist".

Lo-Hed is ingeniously compact yet its working parts can be reached in a jiffy. Spur gear efficiency needs no introduction to you. Low headroom is there when you want it at no extra premium. Gear shafts and trolley wheels are equipped with ball or roller bearings. The motor is a heavy-duty hoist motor. The Lo-Hed hoist is a brute for punishment, as service records show. And we're building it today with the same fine precision and quality materials as always—to last for years to come. Write for the Lo-Hed catalog.

AMERICAN ENGINEERING COMPANY



The Lo-Hed Hoist Is Applicable To Any Monorail System
There's A Balanced Lo-Hed Electric Hoist For Every Purpose

•

Look in your Classified Telephone Directory under "A-E-CO LO-HED HOISTS" for your nearest representative

•

OTHER A-E-CO PRODUCTS: TAYLOR STOKERS, MARINE DECK AUXILIARIES, HELE-SHAW FLUID POWER

AMERICAN ENGINEERING COMPANY
2426 Aramingo Avenue, Philadelphia, Penna.

☐ Please send me your complete catalog of LO-HED HOISTS
☐ Ask your representative to get in touch with me promptly

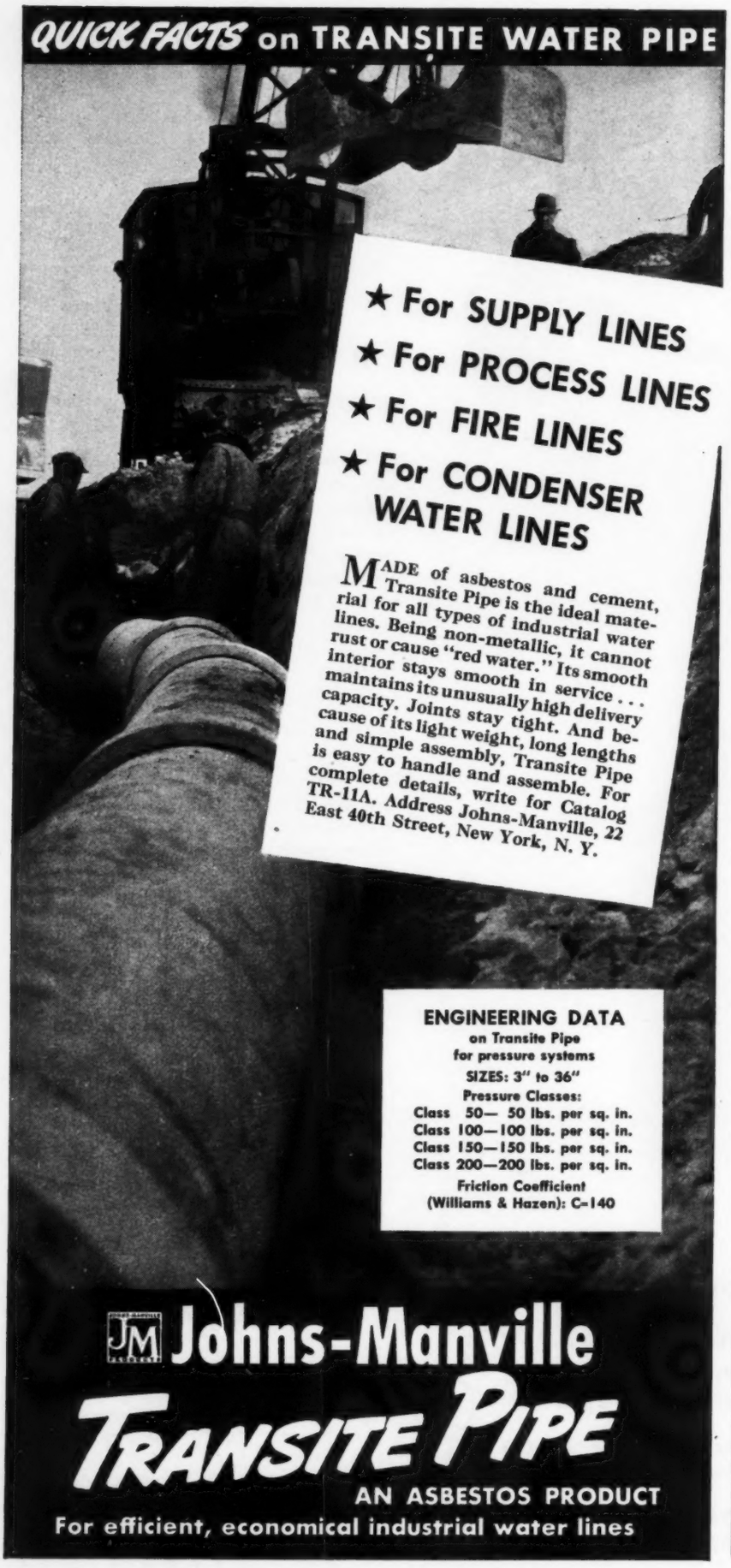
Name_____

Company_____

Street Address_____

City_____ State_____

(Please Print Plainly)


QUICK FACTS on TRANSITE WATER PIPE
★ For SUPPLY LINES
★ For PROCESS LINES
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★ For CONDENSER WATER LINES
MADE of asbestos and cement, Transite Pipe is the ideal material for all types of industrial water lines. Being non-metallic, it cannot rust or cause "red water." Its smooth interior stays smooth in service . . . maintains its unusually high delivery capacity. Joints stay tight. And because of its light weight, long lengths and simple assembly, Transite Pipe is easy to handle and assemble. For complete details, write for Catalog TR-11A. Address Johns-Manville, 22 East 40th Street, New York, N. Y.
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for pressure systems
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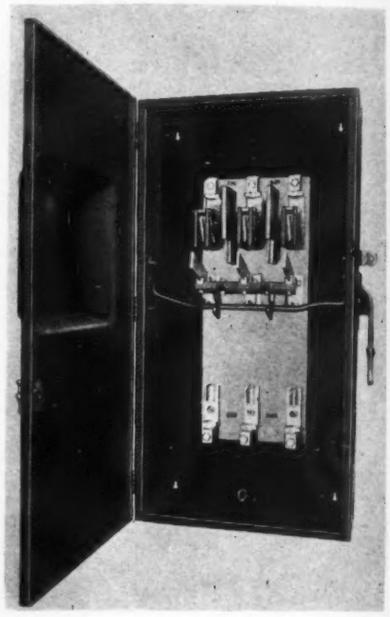
Class 50— 50 lbs. per sq. in.
Class 100—100 lbs. per sq. in.
Class 150—150 lbs. per sq. in.
Class 200—200 lbs. per sq. in.
Friction Coefficient
(Williams & Hazen): C-140
JM Johns-Manville
TRANSITE PIPE
AN ASBESTOS PRODUCT
For efficient, economical industrial water lines

manently wired to the battery terminals. Normal burning time for the unit is approximately 10 hours. General Electric Co., Schenectady, N. Y.

Safety Switch

Safety switch, known as Rolarc, is claimed to incorporate new principle of arc control. Two cylindrical rollers, fabricated from high arc-resistant material, are located immediately above the final disengagement of the current-rupturing members. These rollers form two parallel insulating barriers



and are supported by a specially designed spring tension which, in the free position, holds the rollers flush against each other. Therefore, when the switch blade is opened it passes between the lubricated rollers separating them only by the thickness of the blade. Immediately upon the disengagement of the blade from the "line" stationary jaw, the rollers snap tightly together forming an insulated barrier that interrupts the arc. These rollers rotate with each operation of the switch blade, reducing friction and presenting a new, cool surface to the influence of the arc. Available from 100- to 400-amp. capacity. Federal Electric Products Co., Inc., 50 Paris St., Newark, N. J.

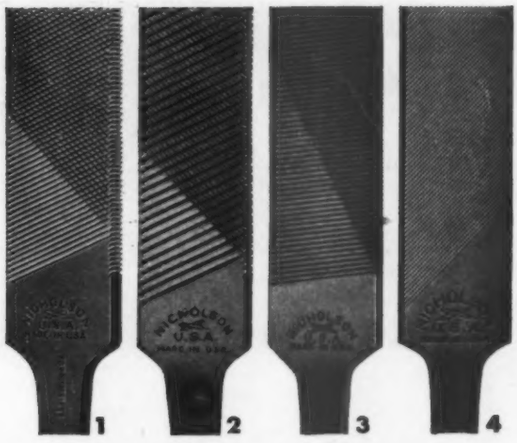
Valve

Faircoseal bronze valves contain preinserted rings of Sil-Fos silver brazing alloy in the port openings instead of threads. Valve and pipe can be brazed into a one-piece piping assembly by an oxyacetylene flame. When valves are connected to brass, copper, or copper-nickel pipe, a Silbraz joint is formed.

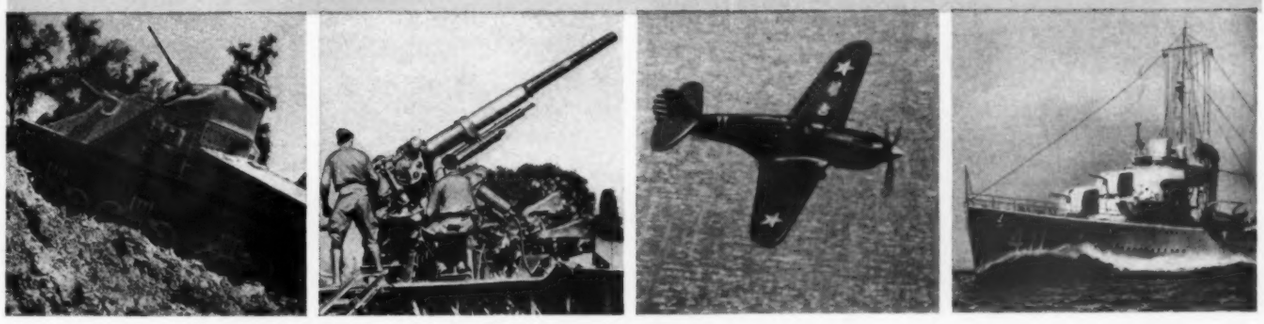
It is claimed that Silbraz joints withstand temperature, tension, compression, torsion, vibration, and corrosion as well as the pipe or tube with which they are used.

Composition of the brazing alloy is as corrosion-resistant as the parts joined, and

The right files for jobs like these



. . . help to speed the right tools



FOR JOBS LIKE THIS . . .

LET'S GO! U.S.A. MADE IN FLIGHT

We MUST win this war . . . with maximum output on our production fronts to put maximum equipment on our fighting fronts. There must be top speed and efficiency down to the smallest detail of war-factory operation.

Filing. Because *The right file for the job* is important, Nicholson has set up specific manufacturing facilities for making special files.

Every Nicholson or Black Diamond Special Purpose File has been definitely proved for *added* effectiveness on the work for which it is intended. Four of the more widely used special types are shown above—(1) For Stainless Steel, (2) for Aluminum, (3) for Brass, (4) for Lathe filing. FREE TECHNICAL BULLETINS *on request*.

For your file needs—and further aid in solving filing problems—contact your mill-supply house.

NICHOLSON FILE CO. • PROVIDENCE, R. I., U. S. A.

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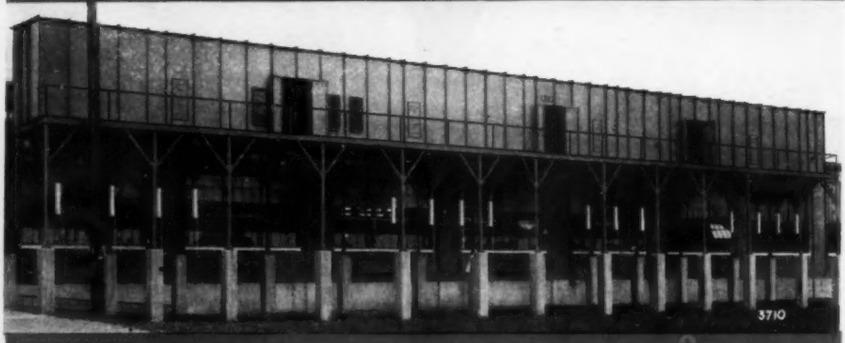
FOR EVERY PURPOSE
NICHOLSON U.S.A. MADE IN U.S.A.

SLY DUST COLLECTOR DOES A 4-FOLD JOB



AT LARGE PRODUCTION FOUNDRY

End view of Sly Dust Filter with standard supports mounted on concrete piers, for truck passage under dust hoppers.

Exhausts—

1—Blast Cleaning Equipment
2—Tumbling Mills
3—Grinders
4—Polishing Wheels and Grinders

This Sly Dust Collector consists of four dust filters, two classifiers, two combination spark arresters and classifiers, and three fan houses, as shown in the sketch. It does a thorough job of exhausting all dust created by cleaning and polishing operations.

Sly Dust Filters offer certain exclusive advantages which help enormously in efficient operation:

(1) Greater filtering capacity because of more filtering cloth
(2) Taut bags (patented) save power and improve dust removal
(3) Bags more easily replaced
(4) Automatic control (any degree) minimizes or entirely removes the human factor
(5) Simpler shaker mechanism results in savings in maintenance and operation

Write us fully. We shall analyze your situation and tell you exactly what can be accomplished. Sly Dust Control pays for itself.

THE W. W. SLY MFG. CO.

4755 Train Avenue — Cleveland, Ohio

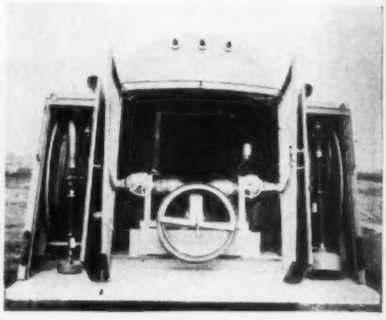
SLY INDUSTRIAL DUST CONTROL

can be used with bronze valves, copper, yellow or red brass, copper nickel, and Monel pipe. Valves can be used for steam, oil, hot or cold water, compressed air, acid, Freon, sulphur dioxide, etc. The Fairbanks Co., 395 LaFayette St., New York.

Carbon Dioxide Fire Truck

Fire truck equipped with a single refrigerated tank holds 3 tons of liquid carbon dioxide, and provides its own fire-extinguishing medium. Refrigerated tank must be kept at low temperatures and is insulated with Dry-Zero.

Fire truck is independent of pumps,



water supplies, or water mains. At the first sign of fire, it is driven directly to the scene, hose is unreeled from the refrigerated tank, a valve is turned on, and immediately a cloud of carbon dioxide vapor and snow (dry ice) is released. It is said to be particularly valuable for electrical, gasoline, chemical, and oil fires. Dry Zero Corp., Merchandise Mart, Chicago.

Controller

A control function is available in Model 30 Stabilog Controller, for application where process-lag is considerable.

According to the maker, Hyper-Reset reduces the effects of a process disturbance

by making initial temporary corrections, which are proportional to the rates of change caused by the disturbance. The normal reset follows, establishing stabilization. The several control functions carried out by Hyper-Reset are simultaneously and automatically adjusted. No tuning in

Structural Materials are Critical and Can't Be Replaced

MAKE CRITICAL MATERIALS LAST

THIS HANDBOOK simplifies your building maintenance problems. It tells you HOW—to harden cement floors—to rust-proof steel sash, tanks and structural work—to slip-proof floors and landings—to dust-proof cement floors and stairs—to acid-proof steel work—to protect and restore wood floors—to reduce sun glare—to waterproof new construction—and how to get efficient, economical solutions to many more maintenance problems. It explains much that you should know about protecting critical structural material.

TRUSCON LABORATORIES DETROIT MICHIGAN

FREE—to plant maintenance executives. Request must be written on business stationery to Dept. F-26.

Light

WHERE YOU NEED IT... WHERE YOU WANT IT...

For full illumination of Parts Bins, Tool Crib Bins and Shelves, Stockroom Shelves, Carton Stacks, File Rooms, Library Stacks — wherever you need "quick, accurate seeing" from top to bottom, install PERMAFLECTORS, the silvered-glass reflectors especially designed for this purpose. Easily, quickly, inexpensively installed. Get prompt delivery . . . No priority on GLASS!

HIGH-EFFICIENCY PERMAFLECTORS of SILVERED GLASS

Conserve Critical War Materials

Assure Prompt Delivery!

Decrease Spoilage — Reduce Accidents — Speed Production

Pick Up

THE WEAK SPOTS IN YOUR PLANT!

Need MORE light, BETTER light here and there in your production line? ✪ Put in Permaflector "Auxiliaries" — the high-efficiency, silvered-glass reflectors that put the light where you need it, as you want it! ✪ A size and shape for any desired distribution. ✪ Easily, quickly, inexpensively installed without affecting work flow. ✪ Use Minimum Critical War Materials! ✪ Specify Permaflectors! ✪ A Pittsburgh lighting engineer will be glad to go over your plant without obligation!

PITTSBURGH REFLECTOR CO.

Pittsburgh Permaflector

407 OLIVER BLDG. - PITTSBURGH, PA.

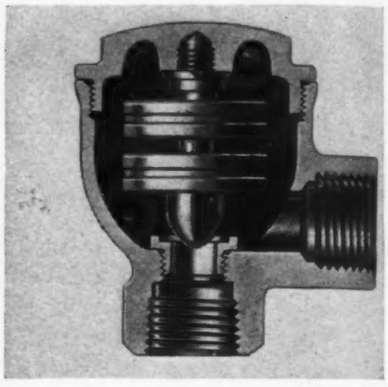
Tear Off

Clip to letterhead. Sign. Mail for complete information, prices.

is necessary. No more than two process adjustments are required, proportional and Hyper-Reset. Foxboro Co., Foxboro, Mass.

Cast Iron Radiator Trap

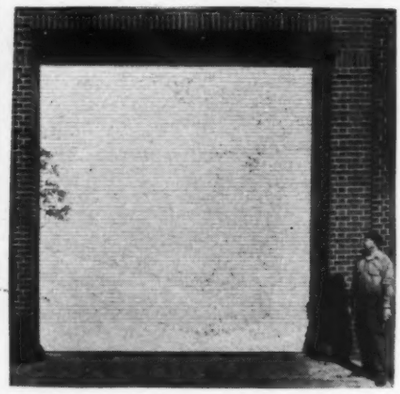
Body and cap of radiator trap are of cast gray iron. Inlet connection is ½-in. left-hand thread—right-hand thread on special order only. Nominal capacity, 200 square



feet of direct radiation. Thermostat is composed of four diaphragms of Adnic, a non-corrosive alloy. Diaphragms will not soften under temperatures above those encountered in service, or crack when subjected to repeated action. All 17D bodies are provided with renewable valve seat. Hoffman Specialty Co., 1001 York St., Indianapolis.

Rolling Wood Door

Rolling wood doors are offered in the interest of metal conservation. Curtain is made of slats formed to roll on each other and to coil overhead. Connected with steel inner bands from top to bottom. A



still further saving of metal is made by using wood guides and plywood overhead covering hoods.

Counterbalance and design can be arranged so that steel curtains can be substituted for the wood at some later date, if desired. Cornell Iron Works, Inc., 36th Ave. & 13th St., Long Island City.

Dust-Tight Panelboard

Panelboard may be used in atmospheres containing carbon black, coal or coke dust, grain, and similar dusts. Panelboard

Better Bearings for IMPROVED MACHINE TOOLS

☆ Today the machine tool industry finds Bunting Bronze Bearings available as always and in advanced forms fully meeting war industry needs. Our Machine Tool Bearing Division is constantly aiding in the engineering of bearing applications in machine tools for precision work never before achieved in production. We can valuably aid you if you have such a bearing problem... The Bunting Brass & Bronze Company, Toledo, Ohio. Warehouses in All Principal Cities.

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BUELL DUST RECOVERY SYSTEMS PLAY AN IMPORTANT PART

The sea is a limitless source of magnesium—the "miracle metal" that's both fire for incendiary bombs and lightness and strength for the bombers that drop them.

Extracting millions of pounds of magnesium from sea water is the big job of one of America's biggest chemical producers. Details, of course, are secret but Buell Dust Collectors play an important part. The patented van Tongeren cyclone (an exclusive feature of Buell Dust Recovery Systems) offers exceptionally high efficiency without increasing operating cost. Buell equipment is widely used in

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If your business has a dust problem, it will pay you to investigate the many advantages of Buell Dust Recovery Systems. Ask to see a Buell engineer.

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CONSULT BUELL *First* IN DUST RECOVERY
for Chemical • Rock Product • Metallic • Food • Flue or any other dusts

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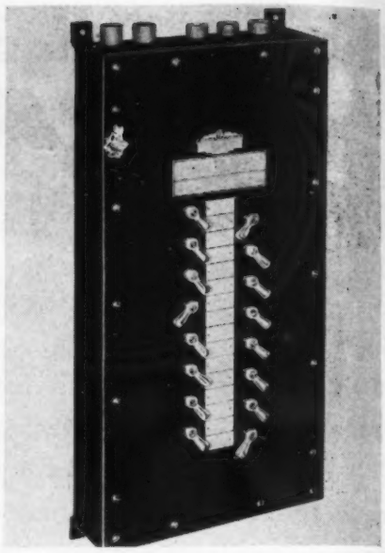
DUST RECOVERY SYSTEMS

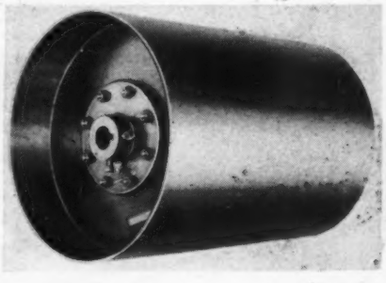


has a solid steel dust-tight front plate, gasketed all around, and secured to the extra-wide flange with screws. The corners of the box are welded, and mounting brackets are welded to the back of the box. Conduit outlets are dust-tight welded hubs. There are no screw openings through the box.

The circuits are externally operated by dust-tight handles through bushings in the cover plate, engaging the regular handles inside the cabinet. Frank Adams Electric Co., 3652 Windsor Place, St. Louis, Mo.

Tight-End Conveyor Pulleys

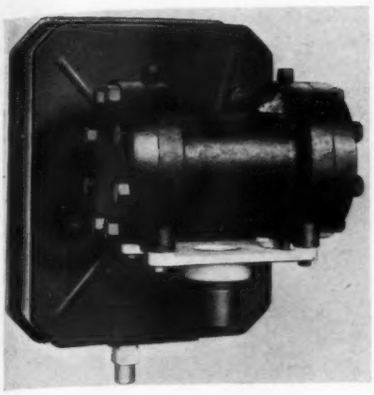
Made with tight ends, Type WN conveyor pulley is easily kept clean. No spilled materials, dust, or water can accumulate inside the pulley. Made of



rolled steel, light in weight, and practically unbreakable. Removable, interchangeable hubs assure quick, easy mounting. Pulley diameters, 6 to 36 inches. The American Pulley Co., 4200 Wissahockon Ave., Philadelphia.

Aneroid Manometer

Metal bellows in aneroid manometers respond to the pressure variations, insure faster response, and react to sudden changes in flow. Built to withstand high over-range without damage. Torque tube assembly gives a completely closed system and eliminates friction and lubrication it is claimed. Friction, lost motion, and



wear are reduced by the absence of internal pivots and springs.

Under steady flow conditions manometer is accurate within 1 percent of scale range, according to the manufacturer. Available for all types of indicating and recording meters and controllers for standard ranges between 20 and 500 inches of water. Range can be changed on the job by substituting precalibrated torque tubes. Taylor Instrument Companies, Rochester, N. Y.

Wood Lockers

Industrial wood lockers in standard and special sizes of folding-hinged design permit easy, economical shipping, and provide erection simplicity. Any handyman can quickly make installations. Most standard sizes are manufactured in units of four single-tier or eight double-tier sections. Each section conveniently folds into

knocked-down position for shipping or movement. Panel construction is plywood, moisture-resistant treated. Door frame is 1 inch poplar, and doors are ¾ inch plywood with slotted louvers. Locking devices are optional—either keyed locks or hasps for padlocks. Two double coat-and-hat hooks are provided. Lockercraft Co., 112 Harter Bank Bldg., Canton, Ohio.

Cleaning Material

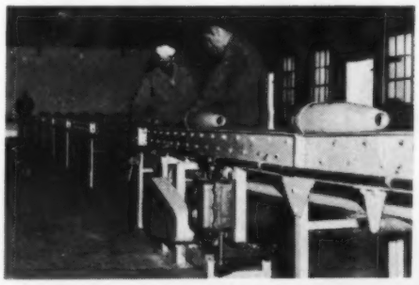
Cleaning material, known as Oakite Compound Co. 84, is of an acidic nature, removes scale, rust, insoluble soap deposits, stains, and discolorations. It removes stains and deposits from windows, filter

"THANKS FOR THOSE SHELLS and I'm Counting on You for More!"

"LOOK what we're doing with 'em . . . those shells we get. The Japs don't like it!

"But I need more—and quick! My brother works in a plant that makes shells. . . . He writes that the men are doing all they can. But *they* need help, too. Manpower's at a premium. But since the plant put in an Alvey-Ferguson speed conveyor system and an A-F Shell Washing Machine things are humming. 'Endless-stream production' is the answer!

"How about you? Is your plant turning out war work as fast as it can? I'm betting my life on you. And all I'm asking in return is—all the ammunition, planes, ships and tanks, you can send me."



Whatever your material handling, product handling or metal product washing problem, our experienced engineers can solve it for you. Write, wire or telephone The Alvey-Ferguson Company, 128 Disney Street, Cincinnati, Ohio.

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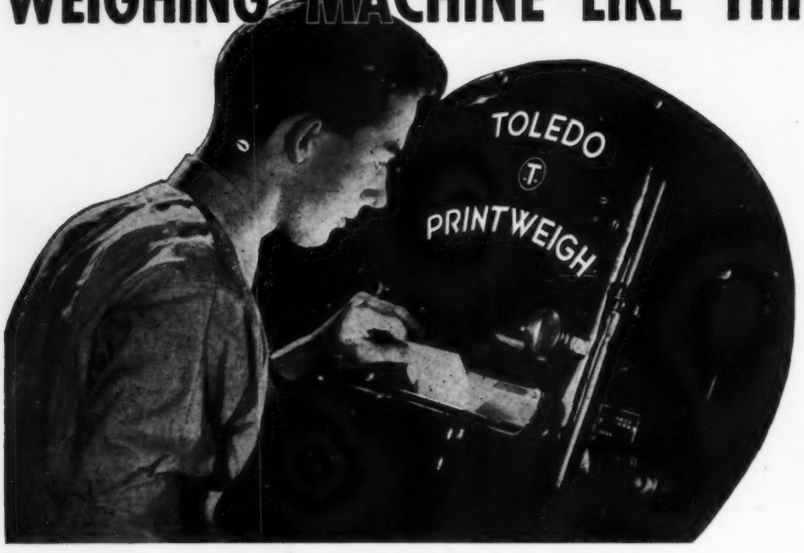
PRODUCT WASHING MACHINES
AND Conveyors

NO OTHER
WEIGHING MACHINE LIKE THIS



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IT PRINTS BIG FIGURES . . . *unmistakably big . . .* on thick tickets . . . on large or small sheets . . . on strips . . . with extra copies.

IT'S SIMPLE IN OPERATION! Prints *direct . . .* no complicated mechanism . . . *dependable . . .* operates in as little as 3/5 second.

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for bulletins and information to help you get greatest scale efficiency. Ask for "45,000 Ways to Weigh". Toledo Scale Company . . . Toledo, Ohio.

cloths, painted surfaces, galvanized water coolers, tile, and enameled surfaces. The glaze or finish of the tile is in no way affected, it is claimed. Oakite Products, Inc., 14A Thames St., New York.

Victory Casters

Casters for tough industrial jobs are provided with a heavy kingpin, ball and roller bearings, semi-steel wheels, and

grease connections. The makers claim they are greatly strengthened. Faultless Caster Corp., Evansville, Ind.

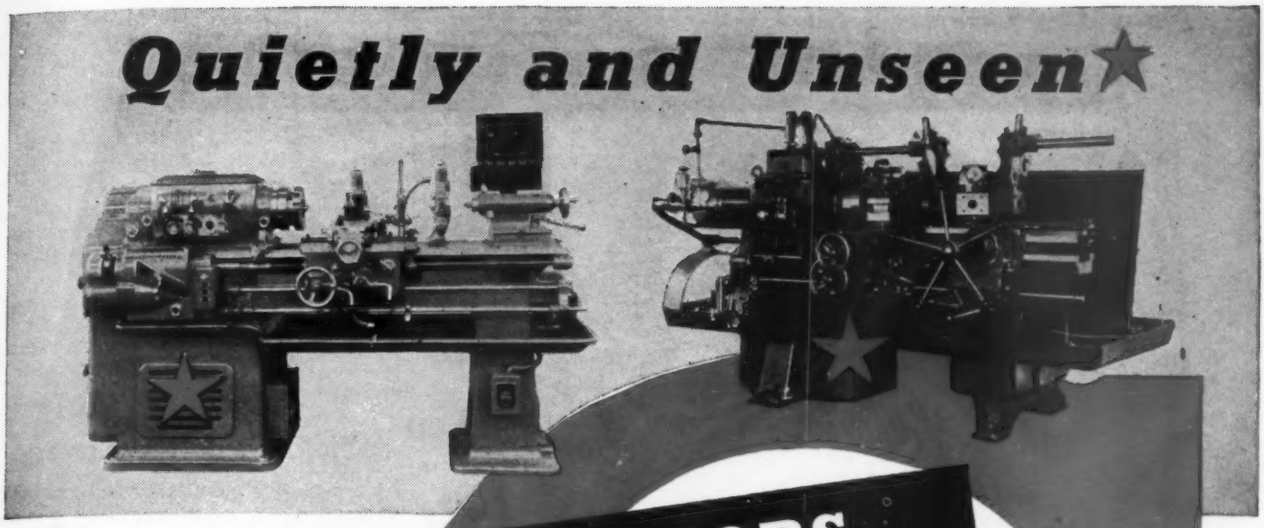
Alloy Material

An alloy material, known as Hardsteel, available in drills, reamers, and tool bits, permits the full-hardening of steel parts before drilling, countersinking, boring, reaming, and machining. This procedure insures accurately spaced holes and cuts, because any distortion caused by heat-treatment occurs before work is done on the piece, it is claimed. It is also effective for plastics and other hard materials. Black Drill Co., Cleveland.

Automatic Electrical Timer

An automatic time switch is arranged to close an electrical circuit after the expiration of a predetermined time, although it can open a circuit by simply reversing the position of the mercury switch element. When used on a.c. circuits, it has a capacity of 1200 watts,

Quietly and Unseen ★



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Century Motors are the unseen dependable servants of thousands of operators of machine tools engaged in War production. Because of their unusual freedom from vibration, Century Motors do not handicap the precision of the machine tool.

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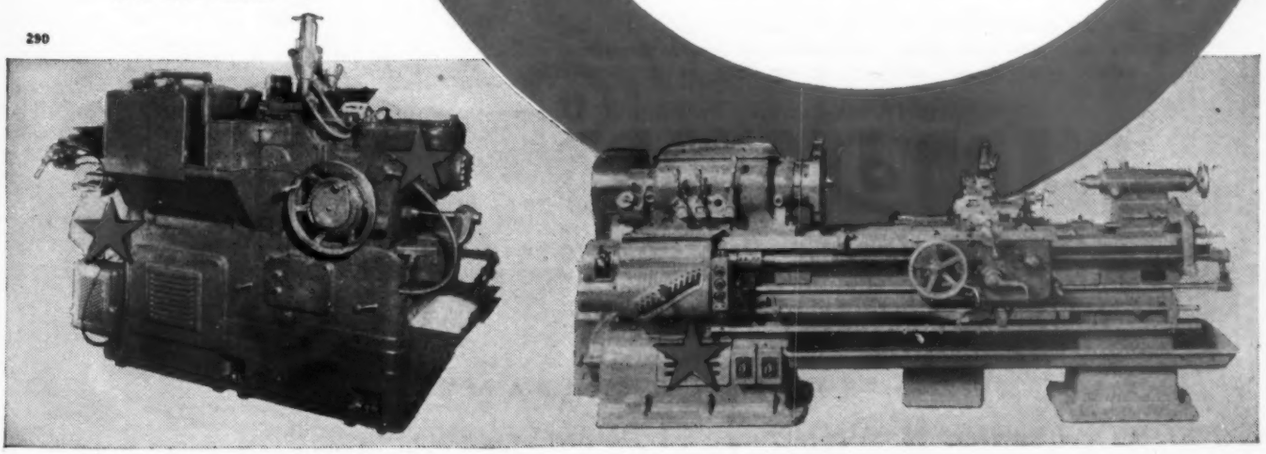

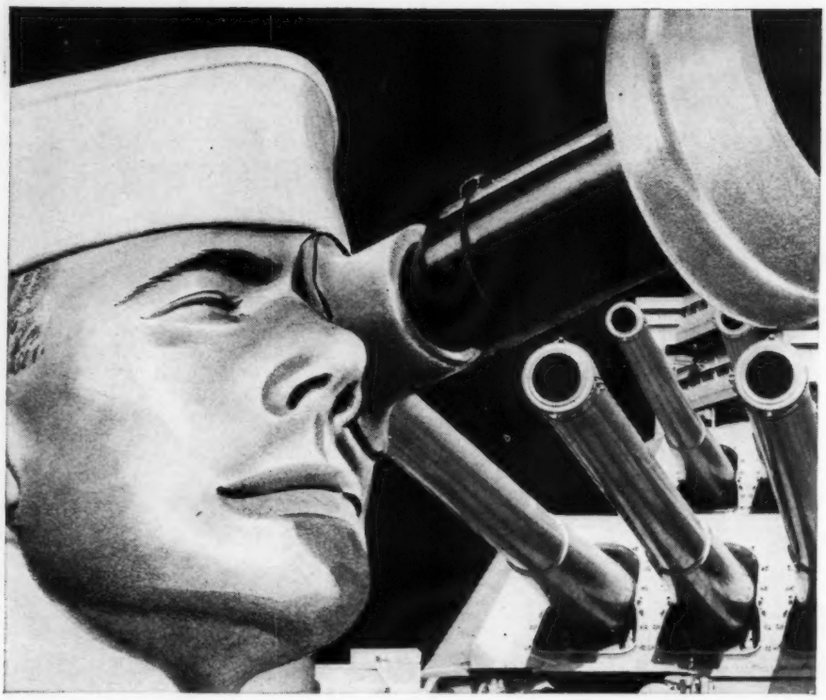

MOTOR CONTROLS
FOR ELEVATING AND TRAINING
THE BIG ONES

Pointing a thousand tons of gun metal with the ease that your neighbor's kid handles his air rifle is an engineering feat in itself. But directing each movement, both horizontal and vertical, so that the projectile pins its mark, miles and miles away, calls for accuracy of controls seldom required by industry. It is a tribute to the accuracy and dependability of Ward Leonard Motor Controls that our Navy is using so many Ward Leonard control devices for this and other vital functions.

We are proud that Ward Leonard Controls developed during the past fifty years, now contribute their part in increasing safety, comfort and efficiency of our men in the service.

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Electric control (WL) devices since 1892.

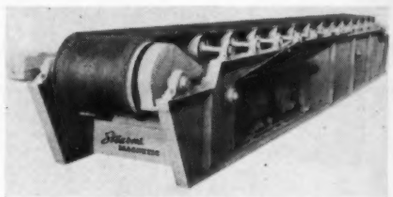
WARD LEONARD ELECTRIC COMPANY
55 SOUTH STREET, MOUNT VERNON, NEW YORK

sufficient to control a 1-hp. motor of the repulsion-induction type. Setting operation merely requires turning a knob to the time (a.m. or p.m.—up to 23 hours in advance) that the switch is to operate.

A series connector with 5 feet of heavy-duty cord is supplied. Connector plugs into electrical outlet and apparatus to be controlled plugs into connector. Installation is completed by fastening timer to wall above electrical outlet. Electrical circuits controlled by wall switches can be adapted for "timed" operation by removing wall switch and installing automatic electrical timer over the switchbox. Philco Corp., Tioga & C Sts., Philadelphia.

Metallic Refuse Sorter

A combination picking belt and magnetic pulley separator unit, for reclaiming brass and secondary metals from junk and metallic refuse, has been announced. Arrangement of picking belt ahead of the magnetic pulley provides hand sorting



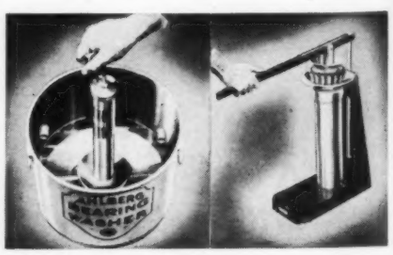
to eliminate bulky junk before sorting the remaining metallic refuse. Drive is by motor reducer and generator installed within the machine. Separator is built in sizes to suit the application and is equipped with antifriction bearings throughout. Stearns Magnetic Mfg. Co., 620 S. 29th St., Milwaukee.

Bicycle-Parking Rack

All-wood racks for parking bicycles are available in 18 bicycle sections. These racks are 36 inches in length, width, and height, and are sturdily constructed. Greene Mfg. Co., Greene, N. Y.

Bearing Washer

A bearing washer that is portable, and has a sealed compartment to prevent evaporation of the solvent, has been developed so that bearings can be washed, dried, inspected, and then repacked with fresh lubricant. A compressed-air dryer blows the bearings dry and clean. The unit weighs 10 pounds and handles a full range of bearing sizes. Bearing is



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The DISSTON Conservation Control Plan

CONSERVATION ★ SERVES EVERYONE ★

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The Disston Conservation Control Plan has proved a nationwide success in helping industry save tools, time and materials in the Battle of Production.

Disston Conservation Control Cards are serving everywhere in the front line of wartime effort—aiding supervision, training workmen, reducing waste, conserving essential materials.

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Over half a million Disston Conservation Control Cards have been distributed to industries the country over. *You* can get these cards for use in your plant simply by asking for them, whether or not you are a user of Disston products. For complete information about the Disston Conservation Control Plan write today to Henry Disston & Sons, Inc., 924 Tacony, Philadelphia, Pa., U. S. A.

DISSTON BITE-RITE FILES In most double cut Bite-Rite File patterns the teeth are staggered. This produces a file which successfully combines speed of cut, long life and smoothness of filed surface.

THIS BOOKLET contains reproductions of the Disston Conservation Control Cards, an order blank and full information on the Plan. Send for it today!

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lollypops!

● However much your gang go for them, you can't make production out of lollypops, candy and tid-bits. Give those men and women food that brings energy, reconstruction of fatigued muscles, new life to tired brains and hands.

Recent vital research proves that real foods brought to worker at bench or machine step up quantity and quality of work. Not safe either to depend on home meals to supply needed horsepower in foods. You must plan the feeding as well as the work.

Ideal Rolling Cafeterias serve hot soups, meats, stews, gravies, vegetables, beverages as well as frozen dainties and cold drinks. All from the same mobile, easily handled Ideal unit.

Look into this. Many standard models with records of proved accomplishment in all war industries. Write for specifications and data.

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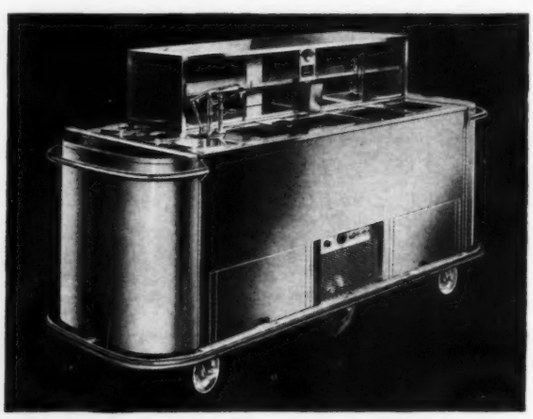

THE SWARTZBAUGH MFG. CO., TOLEDO, OHIO
DISTRIBUTED BY THE COLSON CORP., ELYRIA, OHIO

placed on top of the unit with 5 pounds of clean lubricant in its base, a lever forces the clean grease through the bearing without waste. Ahlberg Bearing Co., 3047 W. 47th St., Chicago.

Heavy-Duty Caster

Series of 8- and 10-inch casters with a minimum of wearing parts are made of steel forgings with the legs, or forks, of heavy bar stock securely welded to the

swivel head. The shape of this fork doubles its strength, the manufacturer claims. The Rapids-Standard Co., Grand Rapids, Mich.

Bomb Extinguisher

A product that, according to the manufacturers, extinguishes magnesium fires and bombs, instead of confining the fire, is being produced. Known as Speedi-Out,

product operates by cutting off the supply of oxygen. It is a hard coal tar pitch that is non-abrasive, non-corrosive, and non-toxic. Has a 6/35 mesh with a softening temperature exceeding 300 degrees Fahrenheit and is packed in 100-lb. burlap bags. Can be applied by anyone, without special training. The only equipment required is a long-handled shovel. Waverly Petroleum Products Co., Philadelphia.

Fluorescent Ballast Control Unit

A fluorescent circuit permits the use of only one ballast—or control unit—with four 100-watt Mazda fluorescent lamps in place of the customary fixtures which require two ballasts for four lamps. Split-phase fluorescent ballast is necessary for the circuit.

The two lamps on each phase of the circuit start in sequence and operate in series. Thus, one ballast does the work

SPLASH PROOF

Complete protection from splashing liquids . . . especially suited for dairies, breweries, chemical process industries, food plants, etc.

TOTALLY ENCLOSED

Non-ventilated type . . . smooth frame motors . . . for use in presence of dust, dirt or foreign material.

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When you must use motors under adverse operating conditions, select one of Master's Protected Type Motors. They are available in sizes from 1/8 to 75 horsepower in a wide variety of electrical and mechanical modifications. Investigate MASTER'S usual ability to serve you promptly and economically with motors that really fit your exact needs.

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Totally enclosed motor with external fan cooling saves space. Ideal for all applications where there are excessive amounts of dust or dirt.

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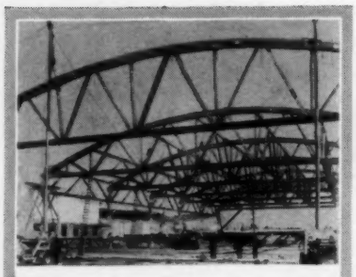
Underwriters approved for operation in the presence of explosive gasses or explosive dusts . . . full protection on such hazardous applications.



These trusses . . . half spanning 100'; the balance 140' and designed to carry 150 tons each . . . were prefabricated, assembled and erected under the TECO System of *engineering* timber to a construction job.

CEILING UNLIMITED WITH TIMBER TRUSSES!

You Can Build That War Plant With Timber! For Less Money! Faster!

SIXTY DAYS after the order was received by Timber Structures, Inc., 8 acres of timber trusses were fabricated in Portland, Oregon, shipped by rail, and erected on this Beech Aircraft job, to roof 356,000 square feet of 'plane construction.

Engineered timber not only saves time, money, and material, but insures a better structure. Modern builders and designers have turned to timber and TECO for short-span trusses as well as long-span. Learn about TECO's wide range of structural possibilities. Full information and literature will be sent on request.

TECO Ring Connectors spread the load on a timber joint over practically the entire cross-section of the wood.

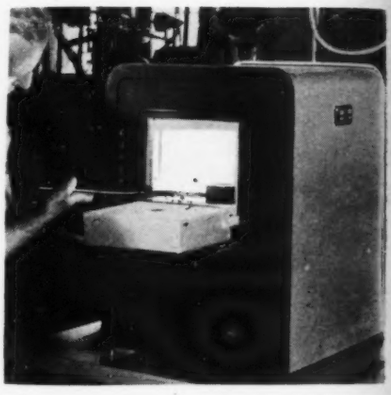
Timber ENGINEERING COMPANY

WASHINGTON, D. C. PORTLAND, ORE.

of two, effecting economies in any fluorescent installation where the circuit can be used. It is for use only with 100-watt fluorescent lamps and on 254, 265, and 277 volt circuits. General Electric Co., Nela Park, Cleveland.

Electric Heat-Treating Furnace

A small electric muffle furnace for heat-treating small parts is offered in two sizes: Type MH-3 has a chamber capacity 8x6x14 inches, and measures 18x22x23 inches outside maximum power consumption, 3400 watts; Type MH-4 has a chamber capacity 10x6x18 inches, measures 18x22x27 inches; maximum power con-



sumption 4800 watts. Operating temperatures—1750 degrees Fahrenheit for continuous, and 1850 degrees Fahrenheit for intermittent operation. Type MH-3 operates on 110 or 220 volts; Type MH-4 on 230 volts.

Furnace is simple in structure; elements are of the embedded type which affords protection to the element wire from atmospheric attack. Four interlocking rectangular elements form the interior of the chamber and replacement is a simple procedure. Furnaces are offered with either automatic or hand control. Cooley Electric Mfg. Corp., 215 S. Senate Ave., Indianapolis.

Extinguisher Powder

Extinguisher powder sprinkled from the 5-ft. tube of Bomb Quench puts out the blazing fire of incendiary bombs, according to the manufacturer. Like a smothering shroud, it softens in the heat, flows over the burning mass, clings to it, forms

BLAW-KNOX STEEL GRATING

GIVES YOU FIVE OTHER IMPORTANT FEATURES . . .

★ One-piece electroforged steel construction for guaranteed strength!

★ Easy maintenance — paint reaches entire surface!

★ Maximum open area for light and air!

★ Self-Cleaning — no sharp corners to clog with dirt!

★ Economical and easy to install — wherever and whatever your grating needs!

Send for FREE paper-weight-size sample

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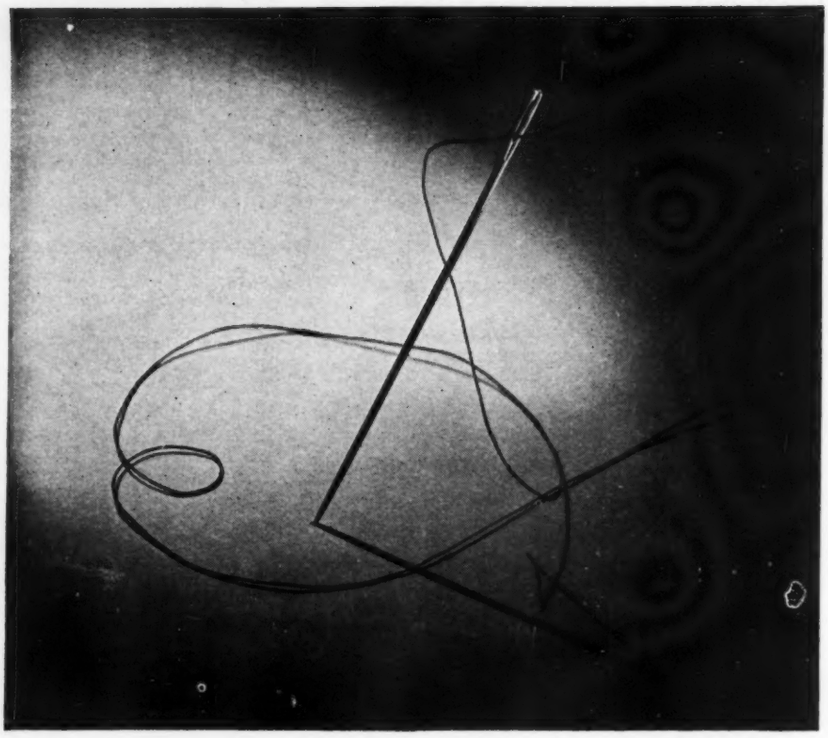

THE EYE OF A NEEDLE

In a needle's eye we see a moral for industry. Just as the delicate job of threading a needle goes easier and faster when there is plenty of light, so the delicate jobs of industry are done better and quicker with adequate lighting, properly placed. You can count on Silv-A-King equipment to give you plenty of light, and on Silv-A-King's 21 years of experience for proper layout and installation. Silv-A-King lighting engineers will be glad to advise you on either fluorescent or incandescent installations.

Bright Light Reflector Company, Inc.,
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Write for new, 16-page Silv-A-King book:
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AC SPARK PLUG
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JONES & LAUGHLIN STEEL
PITTSBURGH PLATE GLASS
and many others

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EQUIPMENT

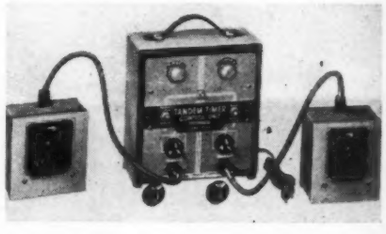
SILV-A-KING MAKES *Light* WORK FOR YOU

a completely airtight cover that stops combustion and creates an exinguishing chemical vapor within the insulated crust formed over the mass of burning molten metal. Although powder forms a solid supporting crust, it is still soft enough to be broken up if desired. Is harmless to handle, and water repellent. O. H. Adams Co., 2018 East Thomas Ave., Milwaukee.

Tandem Timer

A timing device claimed to permit practically any timing sequence is essentially a control unit with two individual and variable plug-in type timing elements. With the timing elements adjusted to their respective time intervals, each cycle of operation will follow the other continuously in regular sequence without further adjustments. Automatic reset features make continuous, as well single cycle operation possible.

Control cabinet measures 8½x8½x5 inches and contains switches, pilot lamps,

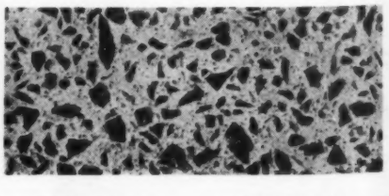


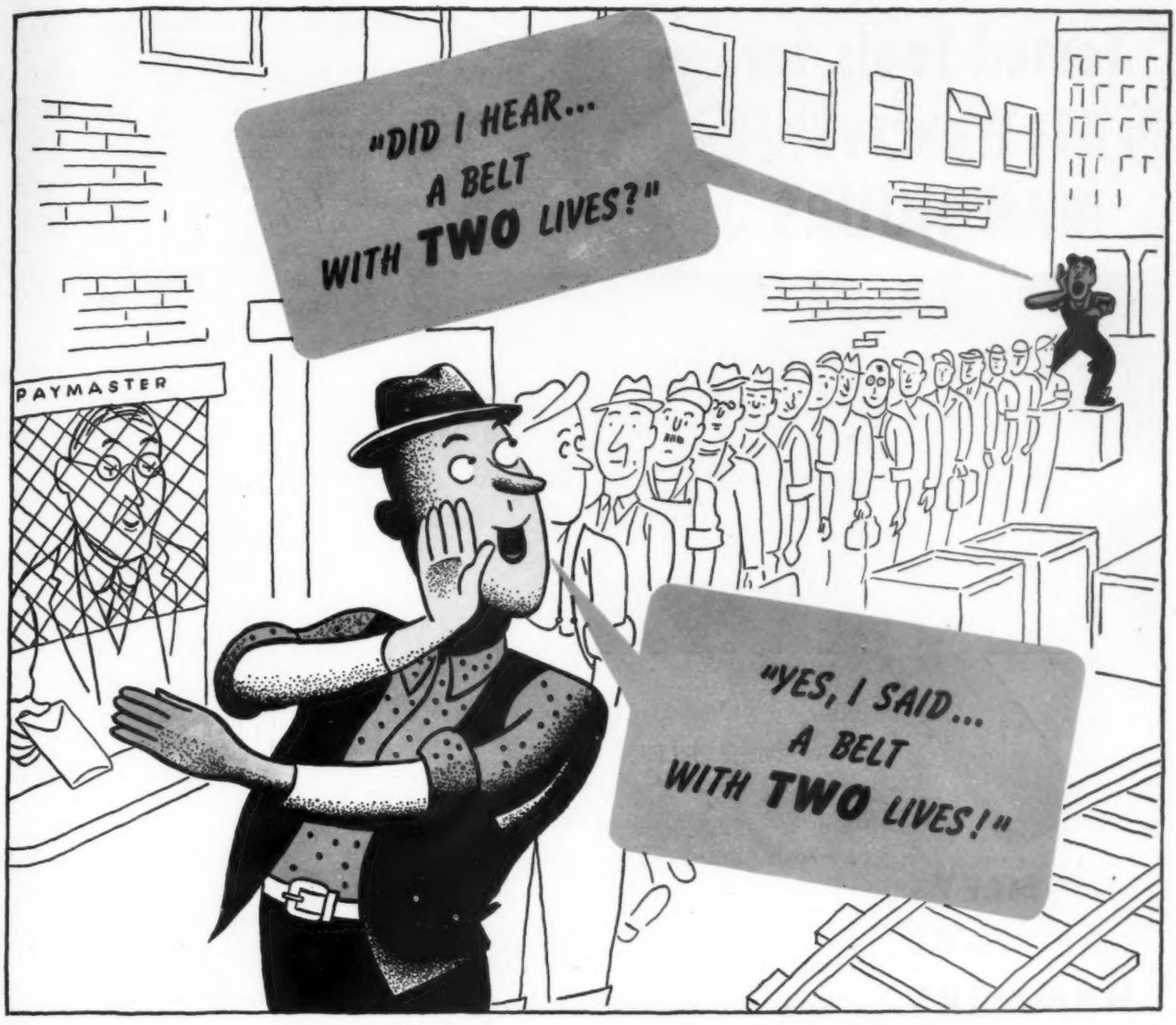
and sockets into which are plugged the two timing elements which control load relays. Relay contacts are rated at 110 volts, 10 amps. a.c.

Timing elements are synchronous-motor-driven, automatic-resetting, of sturdy design and construction, in a formed steel box which measures 5x5x3 inches. Graduated dial and pointer knob allow quick and accurate selection of timing period. Industrial Timer Corp., 113 Edison Place, Newark.

Flooring

Designed to produce non-skid floors, either wet or dry, Cortland Emery Aggregate, a mixture of scientifically graded





Research Leather Belting on "Production Drive" Gives Double Life over Rubber V-Belts

Why leather? Because "The life of a first-quality leather belt on a pivoted motor drive is ordinarily *two or more times* as great as the life of a rubber V-belt on a corresponding drive." The authority is *"Fifty Reports on Mechanical Power Transmission from Motor Drive to Industry"* by Robert Drake.

Why Research? Because it runs with less tension than other leather belts—due to its "built-in" pulley grip and low stretch. It takes the small pulleys without costly "flexing-wear," because the leather is extra-pliable; "tension-cementing" assures ply adhesion.

A more expensive belt can't give you more.
No other belt can give you as much.

Research Leather Belting on Pivoted Motor Base Drive (Production Drive)

GRATON & KNIGHT CO. Worcester, Massachusetts

Only leather belting manufacturer with complete nationwide service facilities. Distributors listed on Graton & Knight page in THOMAS' REGISTER

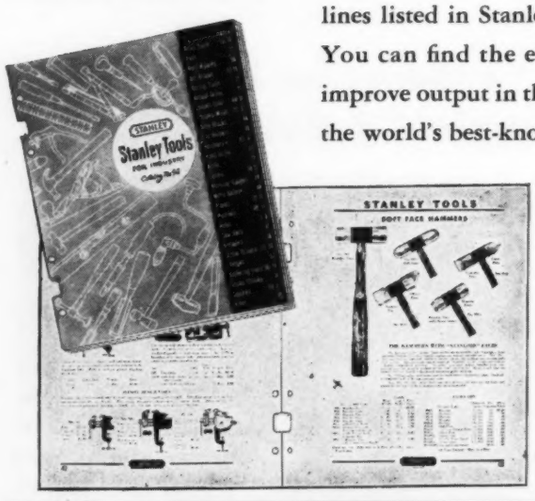
Tested Tools for STRETCHING MAN HOURS

Stanley Soft Face Hammers are helping to put more work into precious man hours . . . saving time and trouble on soft metal forming jobs in aircraft plants, on motor winding, on machine and engine assembly.

The replaceable "Stanloid" tips are tough, resilient plastic, made for long service. Five different styles are offered.

STANLEY SOFT FACE HAMMERS

Hammers are only one of the 17 complete lines listed in Stanley Tool Catalog No. 50. You can find the equipment you need to improve output in this 56-page guidebook of the world's best-known tools.



A Complete Line of Tools under each Index Listing

Stanley Industrial Tool Catalog No. 50 is outside indexed for ready reference ...large illustrations...convenient arrangement. Keep a copy at hand.

STANLEY
TRADE MARK

STANLEY TOOLS
DIVISION OF THE STANLEY WORKS
151 Elm Street, New Britain, Connecticut
THE TOOL BOX OF THE WORLD

large and small, sharp, hard particles of mineral emery, rating next to diamonds in hardness, is announced. For application, the aggregate is mixed with portland cement and water for the floor topping. Flooring is claimed to increase load-bearing qualities. Heavy, loaded trucks will not destroy the surface. Walter Maguire Co., Inc., 330 W. 42nd St., New York.

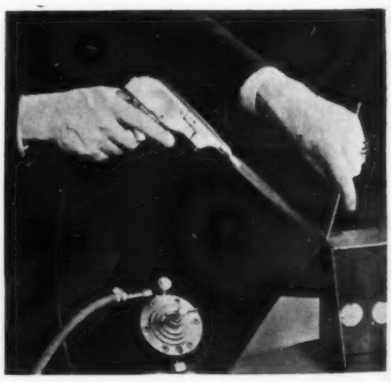
Screw Jack

A 25-ton standard speed, bevel gear, ball-bearing screw jack, No. 7300, is announced. Designed for heavy-duty lifting, lowering, and skidding work, the manufacturer states that the safe mechanical action, screw adjustment, and inclosed ratchet mechanism, combined with both toe and cap lift, make it a jack for heavy industrial work. Jacks can be made with

toe in any position and the base design can be modified. No. 7300 rated capacity is 25 tons on cap and 12½ tons on toe, a 6-in. lift, weighs 82 pounds. Templeton, Kenly & Co., 1022 S. Central Ave., Chicago.

Gas Gun

Gas Gun, an automatic acetylene torch which looks like a pistol, is announced. Just pull the trigger, and the Gas Gun blazes. Used for soldering, silver soldering,



...WINS 10 WAYS

OVER WAR PRODUCTION PROBLEMS

Here's a new weapon to lick slow-downs, production bottle-necks—outmoded conveyor equipment. *Scientifically* strengthened and *precisely engineered*, this Victory Caster converts every foot of open floor space into a flexible production system. Note these features: ★ Double Ball Bearing swivel construction for easier handling of heaviest loads. Hardened bearings rolling around large diameter hardened raceways. ★ Heavy Roller Bearing Axle assures frictionless action. ★ Tough semi-steel wheel stands shocks without fracturing or chipping. ★ King Pin 1⅛"dia. for super-strength, furnished with castellated nut for locked adjustment. ★ Thrust load taken off King Pin by recessing ball race of cone into top-plate. ★ Reinforced ribs on each side of horn, right where most strength is needed. ★ Grease connections for quick servicing. ★ Uniform over-all height assures balanced loads and safe interchangeability. ★ Standardized C-C bolt holes for easy replacement or interchangeability. ★ Full range of sizes and capacities. Write at once for illustrated Victory Catalog and prices.

FAULTLESS CASTER CORPORATION, Dept. FM-9, Evansville, Indiana

Celebrating Half a Century of Service to Industry · Offices in Principal Cities · Canada Factory: Stratford, Ont.

FAULTLESS

BREAK the "Stale Air Shackles" that hold back production

When you "Give 'em air" with Swartwout Ventilation you guard against dizziness and sluggishness that make workers "slip"

YOU may not realize how much extra burden is placed on workroom atmosphere when you add just a few more employees. Added energy heat, extra machines and larger material movements change even a carefully figured air change frequency. . . . One of the easiest steps you can take to increase your output of vital materials is to add new ventilation capacity. With modern high-efficiency Swartwout Ventilators, carefully installed to meet the conditions in your various buildings, you can add needed air movement that clears the excess heat and stale air, and at low cost compared to the gain in employee capacity. . . . Make more speed possible in your plant—with *fewer accidents.* Write for new 1942 Swartwout Ventilator Catalog.

THE SWARTWOUT COMPANY • 18509 Euclid Avenue, Cleveland, Ohio

Swartwout Controlled Air Circulation brings you the special ventilation treatment you need for fall and winter months
Swartwout-Dexter Heat Valve
Swartwout Airjector
Swartwout-Multiple Heat Valve

Swartwout

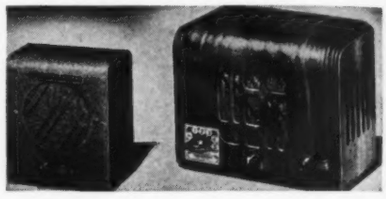
VENTILATION SPECIALISTS

Also Swartwout Power Plant Equipment

light brazing, and lead burning. Gun weighs 20 ounces, is 6½ inches long and 5½ inches high. The gas hose from the acetylene tank connects at the bottom of the pistol grip handle. Ignition is made from a flint, good for more than 500 ignitions. Extra flints are carried in the breech of the gun. Gun is made of solid bronze and tool steel. Gas Gun Co., Salem, Ore.

Intercommunication System

Intercommunicating systems can be made to include all masters to a total of five, a master and a maximum of five substations, or a combination of masters and substations to a total of five units. Operation on all systems is on 110 volts, a.c.



or d.c. Master-station mechanisms are housed in walnut cabinets. Substations are completely inclosed in metal cases.

Stations can be placed at any distance up to 2000 ft. apart, and volume can be adjusted. This system also has the "Silent Feature."

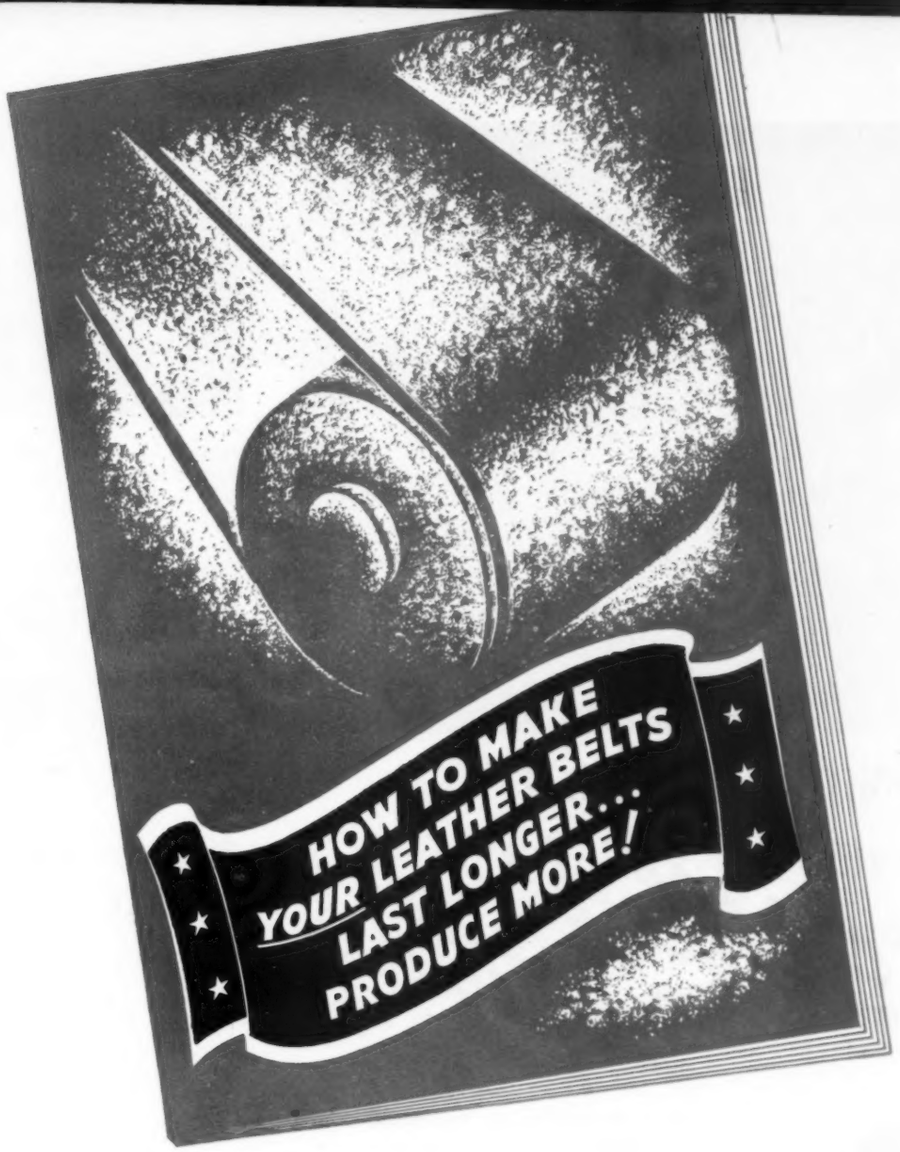
Combination master system permits the use of two or more masters in combination with substations. Substations may be called by either master. The Super Sensitive system uses all master stations and permits a number of two-way conversations to be carried on in complete privacy. All systems are available for use with 10, 20, 30, 40, 50, etc. stations. Talk-A-Phone Mfg. Co., 1217 W. Van Buren St., Chicago.

Magnesium Fire Extinguisher

Cend-Ex is a granulated coal tar pitch conforming to the standards set by the U. S. Bureau of Mines and recommended as being effective in dealing with magnesium bombs and fires. Packed in 12½-lb. rectangular tubes it can be hung on the wall or placed at strategic points ready for instant use. The tube is 30 inches long—enabling the operator to work well away from the bomb or fire. With each tube or Cend-Ex a placard of complete directions is furnished. The S. Obermayer Co., 2563 W. 18th St., Chicago.

Lubricator

Three portable service stations for industrial on-the-spot lubrication of equipment are announced. Each unit is a complete lubrication department ready for instant operation. A unit can be handled by one or several operators simultaneously; convenient hose lengths facilitate servicing hard-to-reach bearings. Combination control valve and meter register amount of lubricants used; outlets provide for high



Forty years of experience...*free*

The combined belting experiences of many men are boiled down into sixteen brief pages titled above. The better we preserve our maintenance materials, the more we can produce, hence this book - - Houghton's contribution to the industrial conservation campaign. A high official of the War Production Board's Conservation Division writes:

"I would like to congratulate you on the excellence of your booklet and your efforts to publicize a practical procedure on the conservation of leather belting."

If you do not have a copy of this factual booklet send in the coupon below. You'll find it full of helpful practical data, with advertising limited to one page only. It will give you in twenty minutes' reading time what many men learned over many years.

●

Your belts will last longer and produce more if they're Houghton Treaded Leather Belts—VIM TRED or OKAY TRED. Only Houghton makes treaded leather belts that grip pulleys better, with less slip.

E. F. HOUGHTON & Co.

Chicago PHILADELPHIA San Francisco Detroit

Please send me the free booklet "How to Make Your Leather Belts Last Longer."

Title _____

Name _____

Company _____

Address _____

Every Shift a "Day Shift" with this "Skilled" Lighting

RLM Duratach Units

Made in Dome, Angle and all other standard types. Wheeler Duratach construction provides for quick and easy interchangeability of reflectors.

RLM Open-End Fluorescent Units

Available in two or three-lamp constructions, units can be mounted from chain, conduit, or directly to ceiling. For use with 48-inch, 40-watt lamps. RLM units for use with 100-watt lamps also available.

Wheeler Installations maintain high-precision lighting levels round-the-clock!

No longer need you count on lower output from your night shifts due to inferior lighting and eyestrain. Modern installations of Wheeler Fixtures give you high-precision "daylight" lighting levels 24 hours a day . . . help to maintain top production with low spoilage on every shift!

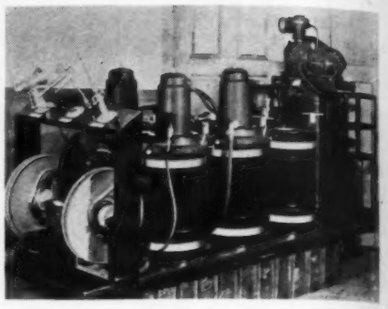
Wheeler Lighting is "skilled" lighting, designed to keep skilled eyes working at top efficiency. Developed through 61 years of specialized experience, Wheeler Fixtures apply standard lamps to produce their maximum of useful light per watt. Available in a complete line of industrial types.

Write for catalog of Wheeler Incandescent or Fluorescent Fixtures. **Wheeler Reflector Co., 275 Congress Street, Boston, Mass.** . . . New York . . . Cleveland. Representatives in principal cities.

Distributed Exclusively Through Electrical Wholesalers

Wheeler REFLECTOR COMPANY

Lighting Equipment Specialists Since 1881



pressure and volume lubrication. Facilities for handling all grades of grease, oils, and slushing compounds include high- and low-pressure pumps, two or more hand-operated low-pressure pumps, and a detachable power head of magazine type.

Portable service stations are supplied with air compressor, or with air hose mounted on reel for quick connection to plant air lines, with shelves, racks, and drawers for tools, waste, etc. Service stations, mounted on a base, measure 3x7 feet and 3x8 feet, depending on model and capacity. Alemite Division, Stewart-Warner Corp., 1800 Diversey Parkway, Chicago.

Fire-Extinguishing Powder

A few handfuls of Whippet, a fire-extinguishing powder, thrown at any fire puts it out instantly, it is claimed. Effective against all types of fires, such as gasoline, benzine, naphtha, tar, grease, oil, electric, acetylene gas, chimney, and forest fires. Simple to use, no equipment is required, is non-poisonous, and contains no noxious gases. Packed in 2½-lb. containers and 10- and 40-lb. cans. The Halco Chemical Corp., 551 Fifth Ave., New York.

Honor Roll Plaque

A plaque to honor men who have entered the Armed Forces is made of a clear plastic sheet, inscribed, and mounted at the top of a finished walnut panel. Directly below and arranged in columns are mounted individual plastic plates on which can be inscribed the names of men in service. Additional nameplates with the pins required for mounting can be ob-

THE *Gilmer* NATIONAL POWER-RECOVERY PLAN

USE WHAT YOU LOSE

IT SPOTLIGHTS POWER WASTE

ELECTRICITY
STEAM
MECHANICAL TRANSMISSION
COMPRESSED AIR
WATER
REFRIGERATION
BOILER ROOM
PRIME MOVERS

Gilmer BELTS

INSTRUCTIONS FOR USE OF ESTIMATOR

Gilmer BELTS

1. The Gilmer National Power-Recovery Plan contains a series of Estimators, each relating to a certain phase of power service such as electricity, steam, hot and cold water, mechanical transmission, compressed air, refrigeration, generation, etc. This Estimator covers that phase of power service assigned to you for checking for power leaks.

2. Spot and check all the leaks in the service. You probably know them well and welcome this opportunity to get the corrections made in order to improve production. The specific practical suggestions below may be helpful.

3. List the location of all principal power losses on the Estimator together with your recommendation for betterment. Group the losses as "Urgent", "Important", or "Less Important".

4. State the approximate time required to correct the power losses, and whether the needed materials for making the corrections are available. If they are not available, state what must be done to obtain them. Give an indication of the cost of the job.

5. Having filled out the Estimator, sign it, and return immediately to the person in your company from whom you received it.

Bear in mind that the objective of the Gilmer National Power-Recovery Plan is to save power. Do your part to make America *powerful* by reporting on this Estimator every principal power leak which it is feasible to correct in your department.

TYPICAL WAYS TO SAVE ELECTRICITY IN THE PLANT

Individual experience will suggest many other points at which power leaks can be plugged and power saved.

Fit the motor to the job—Inventory your motors in all departments. Make sure (a) that most efficient motors drive machines that run longest hours; (b) that each motor is big enough for the job, but no bigger (over-size motors lower power factor); (c) that low-speed alternating-current, direct-drive motors are not used where high-speed AC units with speed reducers would improve efficiency and power factor; (d) that several loads are grouped on one motor where this will reduce power consumption and increase production. **Result: Saving of 15 percent in kwhr consumption and 20 percent in kva load.**

★

Meter electricity to hold down wasteful use—Install individual meters on machines where friction load is likely to "creep up", and on large motors driving machines where operator controls amount of power used. Meter electricity to each factory department and charge department head for his actual consumption; nothing discourages waste like a monthly bill! **Result: 5 to 20 percent saving in total kwhr consumption.**

★

Check feeders to cut losses—Examine entire electrical distribution system to equalize loads on feeders, if necessary by interconnecting load centers. Test insulation to find defects causing actual leaks that sometimes amount to 5 to 10 percent of electricity distributed. Spot and correct overloaded feeders, particularly in buried conduits where overheating can cause failure. Remember that heat is the limiting factor; shift cables from high-temperature areas; rig means of cooling where shifting is impossible. **Result: 3 to 5 percent saving in kwhr consumption; 5 to 15 percent increase in feeder capacity; prevention of sudden failures in the distribution system.**

★

Boost power factor—If power factor is below 85 percent look for motors that are too large for their loads, for drives where synchronous motors should replace induction units. If these changes fail to increase power factor sufficiently, install capacitors. **Result: A boost in the power factor from 70 to 90 percent increases peak capacity 30 percent.**

★

Schedule loads to cut peaks—If peak load is high in relation to average loads, examine necessity of every load that contributes to the peak. See if some production operations can be staggered and if non-essential loads (air-conditioning for example) can be cut off during peaks. **Result: Capacity is increased 100 kw for every 100 kw shifted from peak.**

★

Lighting—Inventory all lighting for unneeded high-wattage lamps. Replace filament lamps with fluorescents, if obtainable, to get same illumination with 75 percent less kwhr consumption. Make one man responsible in each department for turning off unneeded lights. **Result: 30 percent saving in lighting kilowatt-hours and peak kilowatts.**

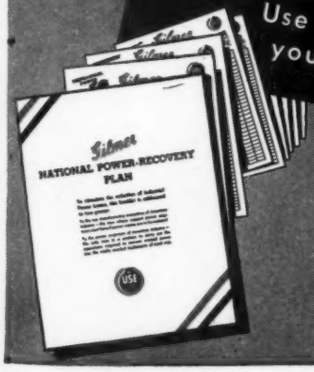
★

Maintain electrical system to cut losses and prevent failures—Organize for systematic cleaning, inspection, and repair of feeders, switchgear, transformers and motors. Establish a definite schedule and responsibility for these jobs, and see that the work is carried out. **Result: Savings of 10 to 15 percent by the proper care and lubrication of motors and mechanical power transmission equipment; breakdowns are prevented which cause vital production outages.**

★

The savings shown above are based on the experience of leading power engineers in hundreds of average plants throughout the country.

The Gilmer National Power-Recovery Plan is all contained in one convenient booklet. Use this coupon to get your copy.



L. H. GILMER COMPANY, Tacony, Phila., Pa.

Gentlemen:

Please send me a copy of the National Power-Recovery Plan, without cost or obligation.

Name_____

Firm_____

Address_____

The Sponsors of Fibber McGee and Molly make good paint, too!

JOHNSON'S

Wax-Fortified

MILL WHITE

Made by the makers of Johnson's Wax

Superior Dirt Repellency
Better Light Reflectivity

New performance standards are here for Mill White! They're made possible by a remarkable achievement in paint formulation . . . the impregnation of paint with genuine wax. Johnson's Wax-Fortified Mill White leaves a wax-smooth surface of outstanding whiteness. The surface resists dirt, moisture, marring, soiling. It cleans quickly and easily. Light-reflective values are retained longer. These qualities are especially advantageous now that both manpower and materials must be conserved. Write today for new booklet, "The Why and What of Wax-Fortified Paints."

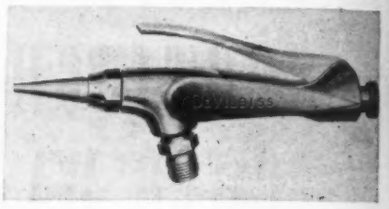
S. C. JOHNSON & SON, Inc.
Industrial Maintenance Division
Dept. FM92, Racine, Wisconsin

tained as needed and easily attached to the walnut panel. The firm name appears in gold on a plastic plate. Color scheme is gold, red, and blue.

Made in sizes 10x16 inches for 16 names and up to 22½x42 inches for 200 names. M. M. Gottlieb Associates, Inc., Allentown, Pa.

Flow Gun

A tool for calking, cementing, and other flowing operations for plastic materials such as crack fillers, sealing compounds, and heavy paints is the flow gun, Type SGE. Manufacturers claim less restriction



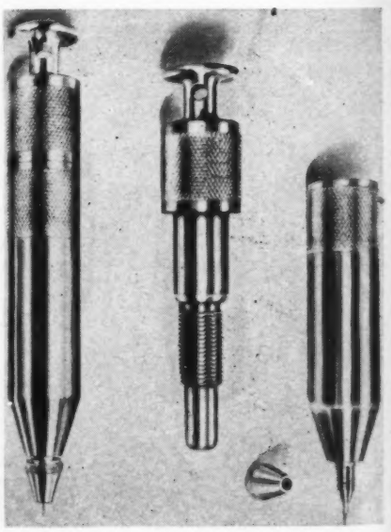
to flow of material and ease of handling. Small, lightweight, well-balanced, it fits the hand and is easily operated. Material is fed under pressure and extruded into cracks, grooves, and over seams to be sealed. The volume of flow is controlled by regulation of the pressure or by a simple adjustment of the fluid needle. Nozzles for all materials are available. The DeVilbiss Co., 296 Phillips Ave., Toledo.

Tool Stands

Tool stands are handy for individual storage of tools for workers on one, two, or three shifts. Drawers can be locked to guard against theft, and are easy sliding. Lyon Metal Products, Inc., 3214 Clark St., Aurora, Ill.

Precision Plumb-Bob

A feature of a plumb bob, known as the Precision Plomb Bob, is said to be the use of phonograph needles, assuring a true and constantly sharp point at practically no replacement cost. Needle is held by a



"What a whale of a job THAT saved us!"

"When P&H built cranes for us before, we had them do it on our specifications. This time, we simply dropped our problem in their laps. They engineered the entire job down to the last detail . . . showed us new advantages . . . furnished our cranes complete with all electrical apparatus. And that saved us the whole tedious job of drawing up specifications!

"With their 55 years' experience in building more than 11,000 cranes, we figured that P&H could best tell us what crane equipment we needed. They did! And moreover we got our crane on the date promised. Next time, we'll do it the same way."

P&H is America's oldest and only crane builder producing complete electrical equipment.

General Offices: 4525 W. National Ave., Milwaukee, Wis.

HARNISCHFEGER
CORPORATION
ELECTRIC CRANES • EXCAVATORS • ARC WELDERS P&H HOISTS • WELDING ELECTRODES • MOTORS

Awarded the Navy "E" for excellence in war production, P&H displays it also as a pledge of future effort.

P&H
OVERHEAD CRANES

Use these modern movable walls

Few, if any partitioning materials can be installed as rapidly as Transite Walls. In many cases these modern movable partitions permit *complete new offices to be erected overnight*. And their asbestos-cement composition assures unusual durability, maximum fire-safety, continued low maintenance. Check these advantages—

QUICKLY INSTALLED—because of a patented construction method. Routine work need not be interrupted. Relocation is accomplished with 100% salvage.

STRONG, DURABLE, FIRE-RESISTANT—Transite Walls provide all the solidity and privacy of fixed masonry walls. They are highly resistant to shock, impact and abuse encountered in factory service.

FORM ANY TYPE PARTITION—free-standing, ceiling-high, solid, or in combination with glass. Ideal for any type of plant or office partition.

ATTRACTIVE APPEARANCE—the natural, light gray color of Transite Walls is ideal for plant or general office use. While this finish is permanent and requires no painting, walls may be painted, or treated with practically any other decorative finish.

RELEASE CRITICAL MATERIALS FOR WAR USE—because Transite Walls are composed principally of asbestos-cement sheets.

For details on J-M Transite Walls, see our Catalog in Sweet's, or write for brochure TR-22A. Johns-Manville, 22 E. 40th St., New York.

Johns-Manville
TRANSITE MOVABLE ASBESTOS WALLS

watchmaker's pin chuck. Hole for the suspension wire is held to size and centered with the indicating point. Upper part of the bob is threaded into the lower. Three bearing surfaces between these parts hold them absolutely concentric. Thus by simply rotating one part upon the other it is possible to raise or lower the indicating point over ½ inch without losing concentricity. Aero Tool Co., 231 W. Olive Ave., Burbank, Calif.

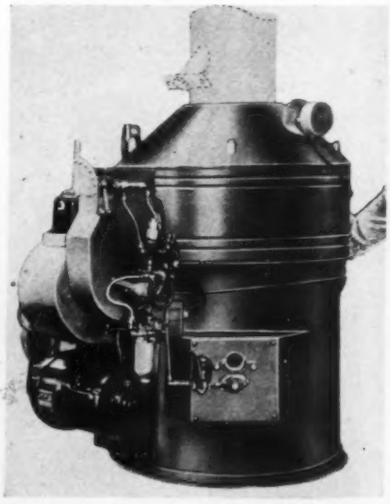
Conductive Asphalt Tile

Conductive asphalt tile that meets the specifications of the War Department for floors installed in government ordnance plants, and which contains no critical materials, has been announced.

It is said that it provides a surface condition which results in less than 0.1 megohm resistance to static electricity under certain specific conditions. No open flames are required during installation or repair; an electric soldering iron does a good job. Suitable as a resilient flooring in industries in which static electricity presents a safety hazard. Armstrong Cork Co., Lancaster, Pa.

Steam Generator

Steam generating unit for use wherever there is a demand for a steady source of steam or an emergency unit, has recently been developed. Generator produces steam

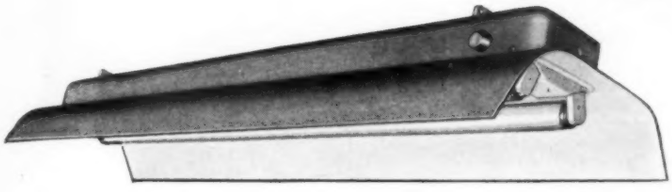


Now Specify the

NEW *type V* Benjamin Fluorescent Units

for Productive Lighting

New Reflector Specifications Provide Efficient Lighting for War Production Plants . .



IN keeping with the program to conserve steel vitally needed for ships, tanks and other war materials, it is now recommended that you specify the new Benjamin "Type V" Fluorescent Lighting Units which utilize a new, highly efficient, non-metallic reflector. These new units are available for either 48" or 60" fluorescent lamps in both the individual open end units (Twin-Flo, Triple-Flo) and the continuous channel, open end units (Lite-Line System).

High Lighting Efficiency

"Type V" units can be depended upon to meet, efficiently and economically, the needs of plants engaged in war production for the high lighting levels and the exceptional seeing comfort that is provided by fluorescent lighting.

Guaranteed by Benjamin

These "Type V" units meet war production plant requirements for good fluorescent lighting. The lamps are adequately shielded for eye comfort. The reflection factor is 80% or more. The reflectors, auxiliary control equipment, sockets and other component parts are engineered for coordinated operation to provide maximum light output and trouble-free operation. "Type V" units are warranted to comply with all recognized illumination, electrical, mechanical and performance standards.

Let Benjamin Help You Meet Productive Lighting Needs

Through these new "Type V" units, Benjamin fluorescent lighting equipment is available to solve many lighting problems confronting plants engaged in, or converting to, War Production. Keener eyes are vital in the production drive, because basic to all production is the ability of the employees to see quickly, accurately and easily. Never has the need for good seeing been greater. Night shifts, six and seven day weeks, and sustained high speed production, have put a tremendous tax on the eyes, health and energy reserve of the worker.

Importance of Fluorescent Lighting to Production Drive

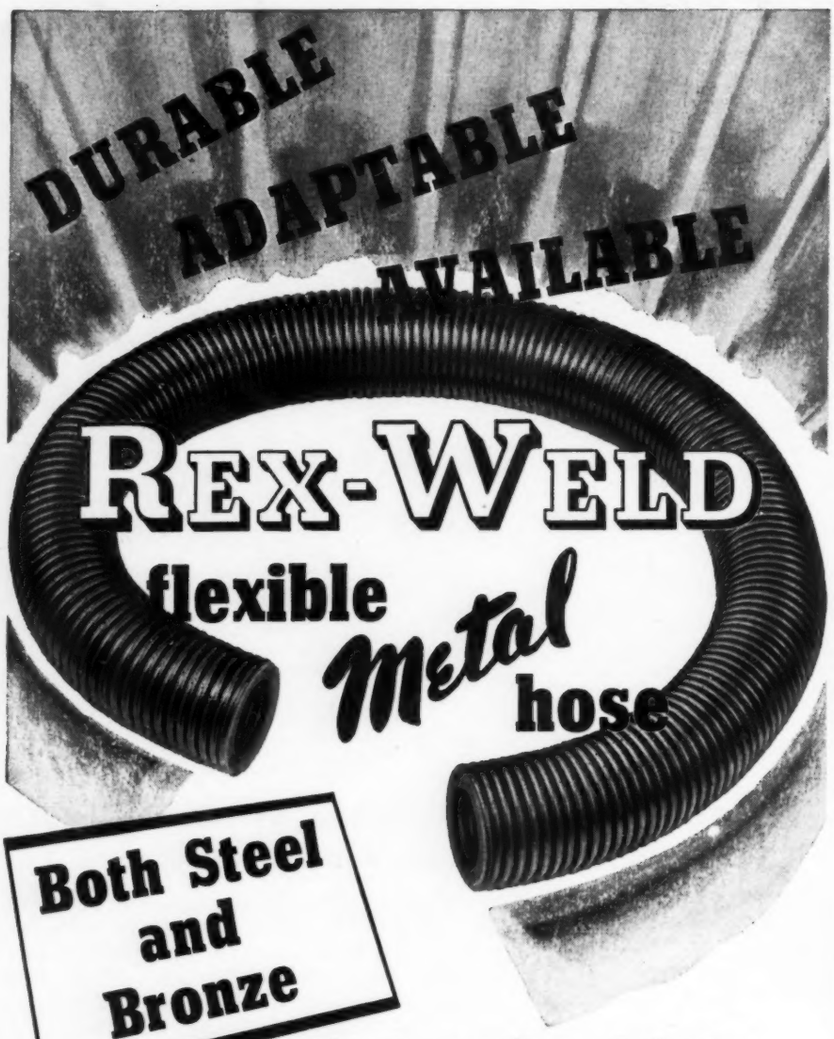
Benjamin "Type V" units provide the amount of light and the quality of lighting needed by the employee to perform efficiently, the seeing task which is part of the work he performs. Such lighting plays a most important part in alleviating the tax on the eyes, in improving the seeing ability, and in minimizing fatigue.

Send Today for New "Type V" Bulletin

For more details concerning the new "Type V" Benjamin units, write for new "Type V" Data Bulletin and a copy will be sent you promptly without cost or obligation. Address Benjamin Electric Mfg. Co., Dept. N, Des Plaines, Illinois.

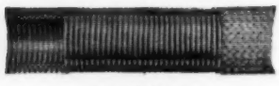
BENJAMIN TRADE MARK *type V* **FLUORESCENT LIGHTING EQUIPMENT**

DISTRIBUTED EXCLUSIVELY THROUGH ELECTRICAL WHOLESALERS



Both Steel and Bronze

The Immediate Solution to Your Flexible Connection Problems!



Type RW-81
(annular corrugations)

Type RW-91
(helical corrugations)

***REX-WELD* (corrugated)**
Flexible METAL Hose

Sizes from ⅛" I. D. to 4" I. D. inc. Pressures to 14,500 p.s.i. Temperatures to 1000° F. One-piece, all-metal construction. Continuous lengths to 50 feet.

Rex-Tite Mechanical (Re-attachable) couplings; solder couplings; brazed and welded couplings and flange assemblies for Rex-Weld Flexible Metal Hose. *Complete data on request.*

Use our production capacity to increase your production

CHICAGO METAL HOSE CORPORATION

General Offices: MAYWOOD, ILLINOIS

Factories: Maywood and Elgin, Illinois

from a cold start to pressures up to 300 pounds in less than two minutes. Available in standard "packages" of 500- 1000- 1500- 2000- and 3000-lb. evaporation per hour. Requires no boiler room or high-draft stack. Automatic or semi-automatic according to specified requirements.

Staggered steel tube coil assembly is easily removed for cleaning. A single motor drives all accessory units with water blower and fuel feed is controlled by steam demand. Interlocked automatic regulation assures safety. Meets all the code requirements including ASME. Vapor Car Heating Co., Inc., Room 1461, 80 E. Jackson Blvd., Chicago.

Fluorescent Extension Cord Light

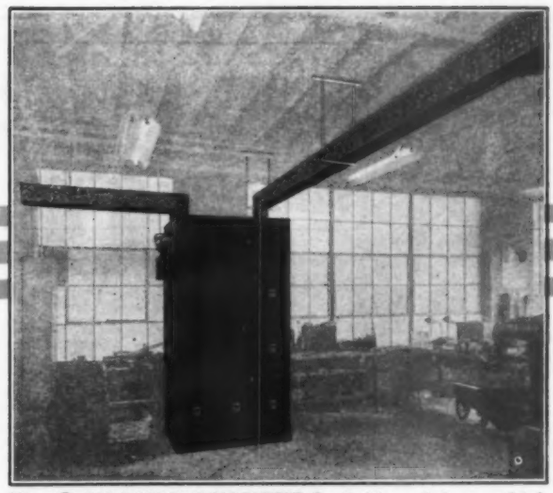
A cool light source is provided by the P-7 fluorescent extension cord unit. Unit weighs only 2¼ pounds, consumes 8 watts,

does not glare, and tube is readily replaceable, it is claimed. Light is 1x1¾x9½ inches, including the grille tube protector, operates on 110-125 volts a.c., and is furnished with 12 feet of cord. Available only on A-1 priority. Hygrade Sylvania Corp., Ipswich, Mass.

Hand Lanterns

Emergency light is made of stamped steel and has a shockproof mounting bracket. Is connected to a gravity type

A part of a "loop" system of Plugin (FA) Busduct feeding a battery of automatic screw machines. Low head-room required duct to be mounted against ceiling.



The (FA) KLAMPSWITCHFUZ Switchboard from which Plugin (FA) Busduct in photo at left is fed. Feeder (FA) Busduct at left runs to an existing distribution center.

Plugin (FA) Busduct mounted on edge, with Plugin Outlets in cover and opposite side, simplifies the conduit layout in this installation with its varied types of machines.

Clip Minutes – Save Hours!

Minutes clipped from the time required to make machine connections to the power line mean added hours of production.

(FA) BUSDUCT

helps speed production. This modern, flexible method for the distribution of power and light makes it possible to "move the machine—plug in—go!" at any desired position; for Plugin (FA) Busduct provides plug-in openings at 12-inch intervals.

Both Feeder and Plugin (FA) Busduct may be taken down and moved to new locations without appreciable loss of material. Extensions may be made readily to existing installations.

(FA) Busduct is designed for 2, 3 and 4-wire feeder systems; 250 volt DC, 575 volt AC, maximum. Plugin type capacities, 125 to 1,000 amperes; Feeder type, 250 amperes and up.

Investigate this Modern Method of Electric Distribution

Let the (FA) Sales-Engineer show you how it may be applied to advantage — whether in new construction or plant modernization. His long experience will be helpful — and he will be glad to consult with you — without obligation. Write for his name and address — or see listing in Sweet's Catalog (Architectural Section or Industrial-Engineering Section), in Thomas' Register or in Electrical Buyers' Reference.

Let us send you Bulletin 65

which gives full details of (FA) Busduct installations, with photographs, diagrams and suggested specifications . . . Frank Adam Electric Company, St. Louis, Mo.

EST. 1891 — THE SIGN OF A BETTER JOB

FA

Frank Adam

ELECTRICAL PRODUCTS

for Defense Industry

FRANK ADAM ELECTRIC CO.

ST. LOUIS, MO. U.S.A.

GREAT IDEA – THIS ROSS ROOF OVEN TO SAVE NEEDED FLOOR SPACE!
WORK IS CONVEYED UP TO THIS OVEN FROM SPRAY BOOTHS BELOW!
COULDN'T HAVE PUT THIS TYPE OVEN INSIDE THE PLANT

with floor space at a premium —additional baking ovens take to the *ROOF!*

Why give up valuable floor space to get that needed extra drying and baking capacity? Why not utilize your roof for an oven and release floor space for other equipment? A number of plants are now operating Ross Roof Ovens to real advantage.

●

Ask Ross engineers to determine if a roof oven can be installed to meet your building, product and processing requirements. They will gladly advise you without any obligation.

●

Write today for our Bulletin No. 130 that treats the entire subject of Industrial Ovens and shows various types of Ross Ovens—for floor and roof. An informative book—yours for the asking.

In plants where the installation of an oven might prove costly due to difficult floor layouts, Ross Roof Ovens can be more economical as well as extremely practical. With floor space at a premium they deserve careful consideration.

AIR FOR YOUR PROCESS
0° TO 1000°
ROSS INDUSTRIAL OVENS AND DRYERS

J. O. ROSS ENGINEERING CORPORATION

Main Office — 350 MADISON AVE., New York, N. Y.

201 North Wells St. CHICAGO, ILL.

12952 Greeley Ave. DETROIT, MICH.

ROSS ENGINEERING OF CANADA, LIMITED, Dominion Square Building, Montreal

relay which automatically closes circuit upon the failure of the normal current supply. Unit is known as Type J-R-1. S. & G. Mfg. Co., 149 Wooster St., New York.

Welder

Heavy-duty air-cooled arc welder, known as the 250 F, contains a built-in cooling system and permits almost constant use at a high-duty cycle. According to the Ergolyte engineers, the air-cooled machine reduces the thermal stress which strains the insulation on uncooled machines and shortens their lives. Capable of handling an electrode from $\frac{1}{16}$ to $\frac{5}{32}$ inches, this model has 24 heat steps, an input voltage

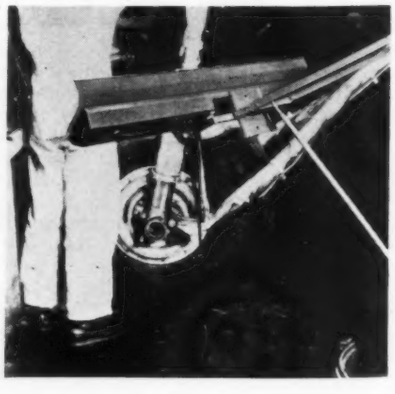
of 230 volts single phase, and a current range from 15 to 250 amps. Ergolyte Mfg. Co., Lawrence St. at Erie Ave., Philadelphia.

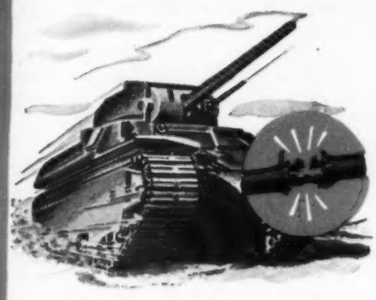
Portable Service Light

Adjustable from 30 inches to 7 feet and designed to project light into many inaccessible places is a portable fluorescent service light recently developed.

Can be used indoors to project light under the areas that are in shadow from overhead lighting. Outdoors, the light is easily portable (merely tipped and rolled on its casters) and throws illumination in any direction.

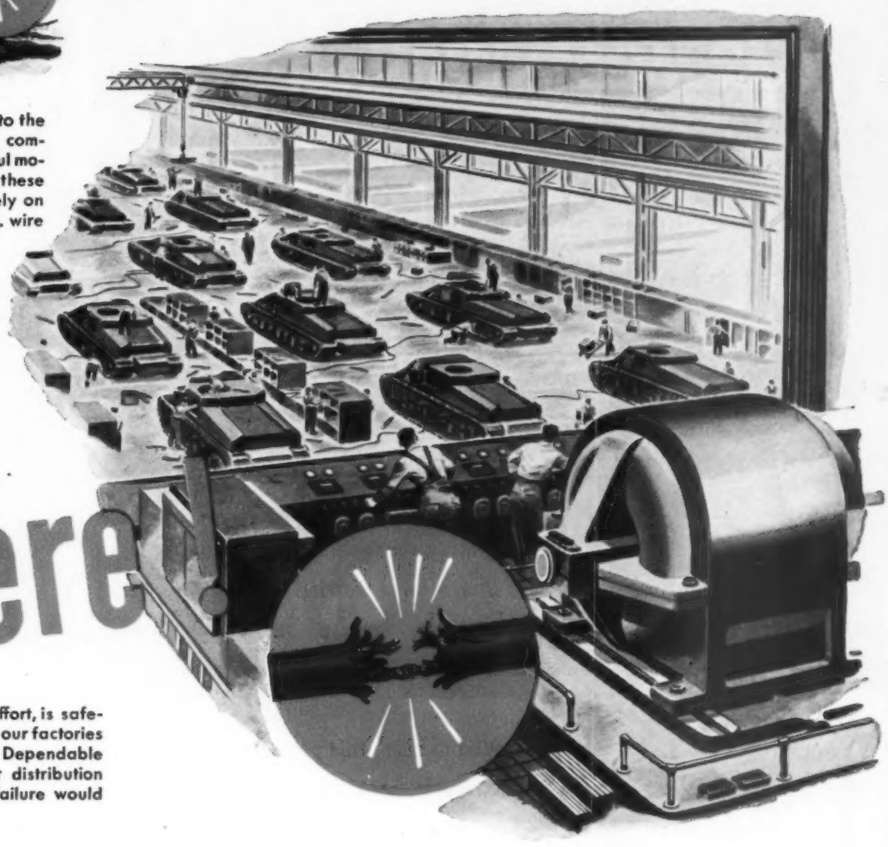
Upward or downward, horizontally or vertically, or in any angle of a 180-deg. arc, unit is adjustable without the use of tools. Cast iron base makes the light





They can't let it happen here!

Electrical power is all-important to the ponderous tank . . . for its radio communication system, for its powerful motor ignition. To transmit current for these vital functions American tanks rely on wires and cables of copper . . . wire failure might be serious.



or here

Important too, to America's war effort, is safeguarding the power that enables our factories to turn out our formidable tanks. Dependable wires and cables are used for distribution of electrical power . . . for wire failure would interrupt production, itself.

ELECTRICAL WIRES AND CABLES OF COPPER ARE THE LIFE LINES OF OUR NATION

Today . . . Anaconda Products are pre-empted for the toughest wiring jobs in war production. Anaconda Wire & Cable Company is devoting its production wholeheartedly to our war effort . . . turning out the most modern types of copper wire and cable, engineered to fit the job . . . and doing it *seven days a week!*

Meanwhile . . . Anaconda Wire & Cable Research carries on: Working with redoubled effort are the research laboratories of the Company . . . investigating and testing materials and methods . . . improving existing products, developing new ones.

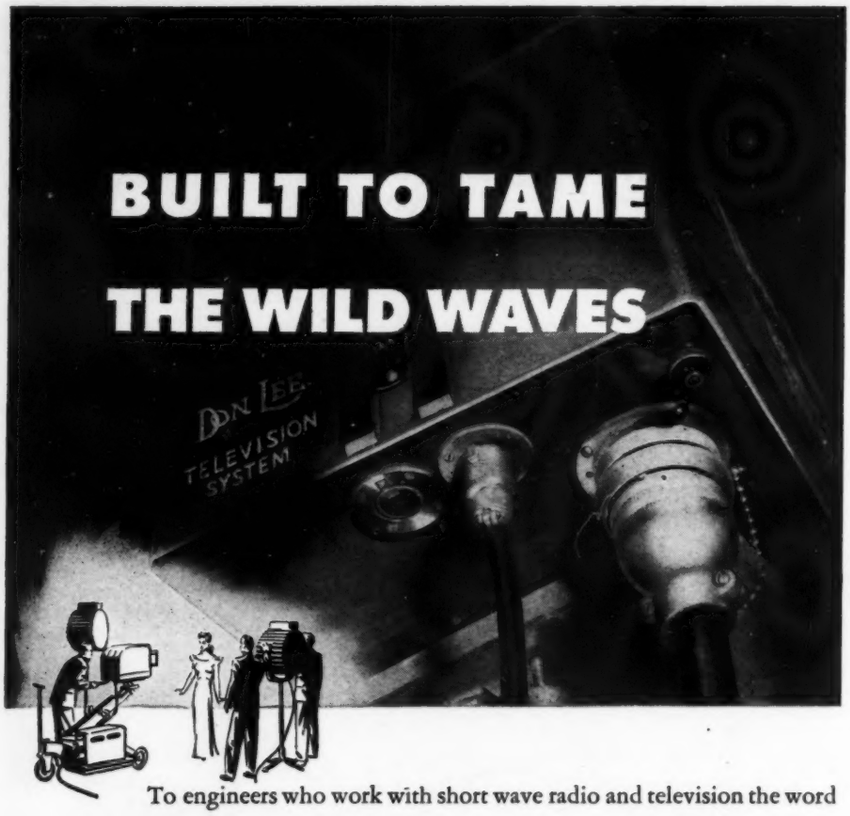
The benefits of this intensive program of original research today are going into our country's war effort. But when the emergency is ended they will be available to industry everywhere . . . a pool of practical information, of product development and improvement . . . even finer wires and cables of copper. 42236

ANACONDA
from mine to consumer

This familiar trade-mark symbolizes the best efforts of modern research and production.

GENERAL OFFICES: 25 Broadway, New York
CHICAGO OFFICE: 20 North Wacker Drive
Subsidiary of Anaconda Copper Mining Company
Sales Offices in Principal Cities

ANACONDA WIRE & CABLE COMPANY



To engineers who work with short wave radio and television the word "shielding" refers to one of their special worries. The high frequency circuits they use are extremely temperamental and unless properly "shielded" have the bad habit of getting out of bounds — with unpleasant results.

Special cables were developed to solve this problem, but there still remained the trick of connecting these wires to different pieces of equipment. It had to be done so that the wire was "shielded" every inch of the way, at the same time permitting quick connections *that stayed connected!*

Cannon Electric has developed the large coaxial plug shown here for this highly specialized purpose. The currents that carry the world's greatest music, as well as the electrical impulses that carry television images, pass through these plugs without loss or distortion.

Cannon Coaxial Plugs of various types carry the voices of American pilots wherever they fight. This is just one of the many kinds of highly specialized Cannon Connectors used wherever electrical connections must be made quickly and with absolute certainty — in tanks, planes, motion picture studios and hundreds of other civilian and military uses.

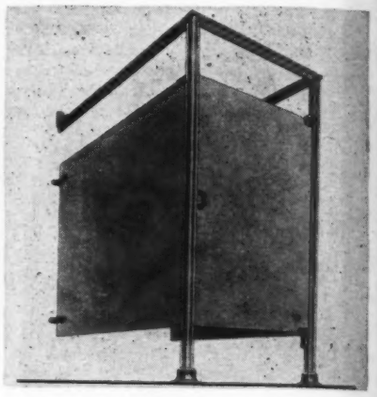
CANNON ELECTRIC
DEVELOPMENT COMPANY
LOS ANGELES, CALIFORNIA

Cannon Electric developed special equipment for the Don Lee Television Station W6XAO atop Mt. Lee in Hollywood.

practically impossible to upset. Other features include power factor correction for the two 48-in. 40-watt fluorescent lamps; a high-baked enamel reflector. Lumidor Manufacturing Co., Los Angeles, Calif.

Wood Toilet Compartments

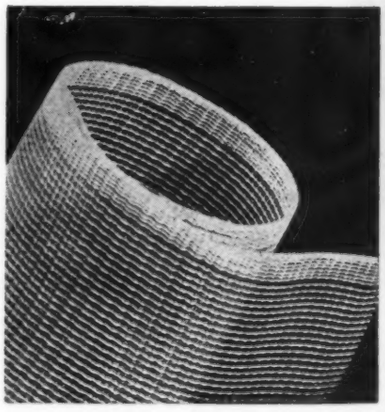
Toilet compartments that utilize 7-ply Douglas fir plywood for partition panels and doors, and are similar in design and construction details to the steel fabri-



cated type, are announced. Known as all wood War-Time toilet compartments, they are offered as temporary substitutes for steel. Sanymetal Products Company, 1700 Urbana Rd., Cleveland.

Safety Cloth

Ceco safety cloth is a tough cotton fabric, woven in 10 mesh, whose openings are filled with transparent plastic. It cannot shatter. Material may be used alone, instead of window glass, or applied inside



over the regular window glass to minimize the shattering effect of nearby explosions. Admits light, resists weather, and is easy to install, the manufacturer claims. Supplied in rolls of 300 feet, 28 inches wide. Colloid Equipment Co., Inc., 50 Church St., New York.

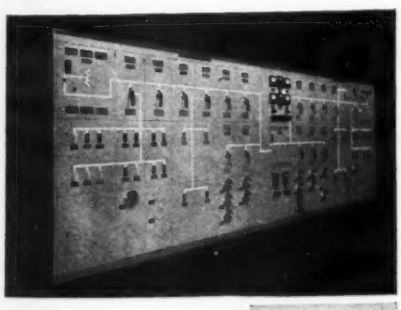
Air Diffuser

Recessed model of spun steel, overhead type air diffuser has flow characteristics similar to those of Venturi meter. Relationship between neck area of unit proper and Venturi throat proportioned to create slight back pressure in neck at all times,

IN PANELBOARDS

CIRCUIT BREAKERS

are by I-T-E



These are readily identified as the work of I-T-E

Steel-enclosed switchboards and individually mounted circuit breakers have carried the I-T-E symbol into the plants of industry. These units represent the work for which I-T-E is known. But, as the text at the right indicates, the field of I-T-E usefulness is even greater.

Another example of a broad, essential service by I-T-E which only a few people would ordinarily know about

Throughout the country are hundreds of electrical contractors who install panelboards in which "switches" for control of lighting circuits in buildings and factories are conveniently centered.

In modern practice, the "switches" are circuit breakers especially designed for panelboard use to provide positive, fuseless protection for each circuit while permitting "off-on" manual control.

A very great many contractors use panelboards and convertible power panels made with I-T-E circuit breakers and I-T-E accessories. Many thousands of I-T-E units are purchased for panelboards and power panels each year. Yet, because the circuit breakers are grouped behind solid, sheet-steel coverings and because the people who have reason to open panelboard doors are few, the identity of the circuit breakers is not generally known.

Of men in industry who read of this widespread use of I-T-E equipment, some large percentage will be working in plants and office buildings in which are panelboards containing I-T-E units. Such readers—and others—may gain a new picture of I-T-E contributions. The part of I-T-E in the field of electrical protection is broad.

Representatives in Principal Cities

I-T-E

AIR SWITCHGEAR

IMMERSED IN AIR — ENCASED IN STEEL

The Army-Navy "E" for Production Excellence

I-T-E

CIRCUIT BREAKER CO., PHILADELPHIA, PA.

FOR WAR PLANT Production AND Protection

PERMAFLECTOR

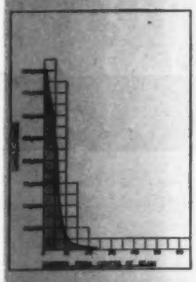
Enclosed FLOODLIGHTS

Minimum of Critical Materials Used

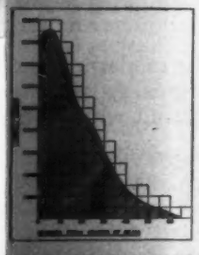
★ Designed and built expressly for our vital war of production, these Permaflector floodlights project a flood of high intensity light which effectively serves to defeat the saboteur or to accelerate the output of war material. These new enclosed Permaflector steel floodlights are complete, ready-to-install and consist of a formed steel case equipped with hinge and clamps, heat-resisting cover glass, cast iron base, wire cord grip fitting, three-foot length of duplex wire, mogul socket and a 1,000-watt size Permaflector, the silver mirrored glass reflector which provides engineered light control from extreme concentration to extra broad spread. Preadjustment at the factory permits the use of 300, 500 or 750-watt lamps with the 1,000-watt size unit. Completely weather-proof and corrosion-resistant, these floodlights are ideal for all outdoor floodlighting applications. They may be mounted on a vertical or horizontal surface or attached to a pipe and adjusted to almost any position.

Other War Uses

Airfields
Army Posts
Arsenals
Bridges
Construction Jobs
Dams
Docks
Mines
Pipe Lines
Power Stations
Railroad Yards
Substations
Viaducts



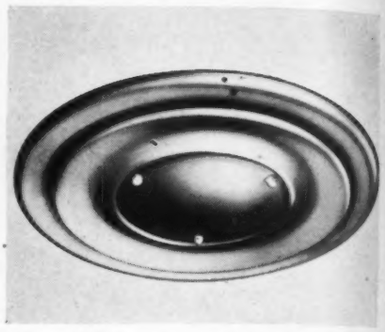
Concentrated Distribution Floodlights Numbers ST-1150-C, ST-1110-C. Addition of Stippled Cover Glass Provides Narrow Distribution.



Broad Distribution of Floodlights Numbers ST-1050, ST-1010.

PITTSBURGH REFLECTOR CO.
403 OLIVER BLDG., PITTSBURGH, PA.

PITTSBURGH REFLECTOR CO. FM-9-42
403 Oliver Building
Pittsburgh, Pa.
Please rush complete data on Permaflector Enclosed Floodlights.
Name.....
Firm.....
Address.....



automatically insures uniform distribution around periphery, it is claimed.

A wide range of sizes and special styles permitting handling air volumes up to 15,000 c.f.m. per unit is available. Barber-Colman Co., Rockford, Ill.

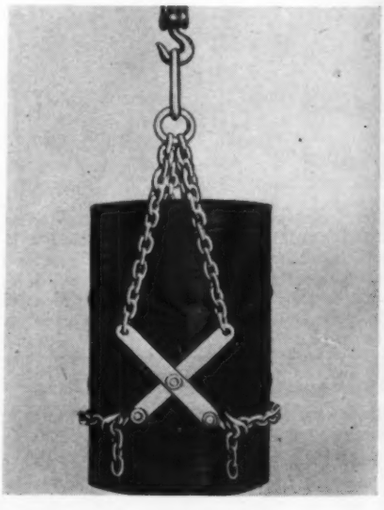
Paint

A paint product designated Valdura Singlekote, primes, seals, and finishes on any interior surface in one coat. According to the manufacturers, it combines the hiding power and economy of water-type paints with washability, durability, and performance of oil-type coatings. It may be applied to plaster, concrete, brick, wallboard, wood, wallpaper, and metal surfaces, unpainted or coated with calcimine or casein paints, providing the old covering is bonded, or tight to the wall. It easily covers dirt, but is not recommended for use on oily or greasy surfaces. Product is self-leveling, sets within two hours, dries within 12 hours, and provides a dead-flat finish. Coverage is up to 750 square feet per gallon.

Packed in 1-gallon cans, 5-gallon pails, and in drums, is available only in white, but may be tinted with alkali-resistant colors in oil. American-Marietta Co., 43 E. Ohio St., Chicago.

Barrel Grab

Barrel grab picks up any type of steel or wood barrel, box, or container from 40 inches in diameter down to small nail-keg size. Will lift up to 200 pounds; the heavier the load the tighter it holds. Toggle constructed of ½x2-in. flat bar stock and pivoting pin of 1-in. cold-rolled



... *begins with* PAPER WORK ROUTINES

Thundering an *action* reply to the challenge of attack, industrial production is mounting to record levels. The increasing volume of its roar is reaching into far places, but urgency is demanding better and better use of *time.*

Time that can be *saved* can win the Victory, and *work simplification* is the champion timesaver. For opportunities to simplify procedures that help to control production, look to *paper work routines.* For the means to better results from paper work routines, look to Addressograph-Multigraph methods.

Effective *organization* of paper work, with *increased production time, prevention of mistakes and waste,* and *accurate costing of operations,* is specialized work that Addressograph-Multigraph methods have been accomplishing for many, many years.

USERS OF OUR PRODUCTS are entitled to the services of our Methods Department. It can help to extend the use of their equipment in Purchasing, Storeskeeping, Production, Marketing, Shipping, Billing, Collecting, Disbursing and all key operations of business. To those who are interested in up-to-date information on better methods it is available on request, without charge.

ADDRESSOGRAPH-MULTIGRAPH CORPORATION • *Cleveland, Ohio*

Addressograph and Multigraph are trade-marks registered in the United States Patent Office

Addressograph-Multigraph Methods SAVE BRAIN HOURS AND HAND HOURS

45 Billion

GEAR TOOTH CONTACTS
(500,000 PER MINUTE)

.. without measurable wear

A prominent manufacturer added "dag" colloidal graphite to his grease for a test involving 1500 hours of running time and 500,000 gear tooth contacts per minute. *No measurable wear* was detected . . . Subsequent performance of the test grease *without* "Oildag" (colloidal graphite in oil) was unsatisfactory . . . Send for comprehensive report by their test engineer and bulletin No. 220 E

ACHESON COLLOIDS CORPORATION
PORT HURON, MICHIGAN

"Dag" and "Oildag" are registered trade-marks of A. C. C.

dag COLLOIDAL PRODUCTS

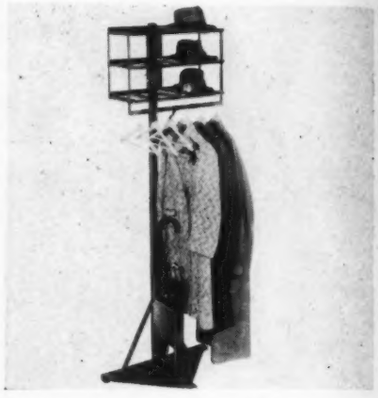
The electric-furnace graphite used in "dag" products is made in U. S. A.

To Industry: "Dag" Colloidal Graphite is a lubricant – resists extreme temperatures and pressures – is electrically conductive, opaque and chemically inert – can be suspended in many liquids including the lighter viscosity fluids.

steel with retainer head. Chain is ⅛ inch, spacer and hoisting bar, ¾ inch. Palmer-Shile Co., 7104 West Jefferson Ave., Detroit.

Wood Wardrobes

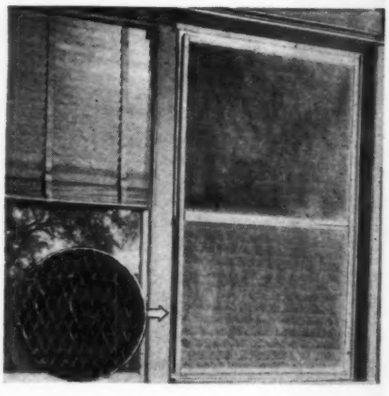
All-wood wardrobes that are so nearly identical in design and finish to existing steel racks that they can be used as add-on units. Wardrobe racks come single (wall type) or double (back to back) in



standard units or any length by the foot. Accommodate three or six persons per running foot, and provide for hats, coats, umbrellas, and overshoes. All clothing is kept open to light and air. Vogel-Peterson Co., Chicago.

Blackout and Shatter Screen

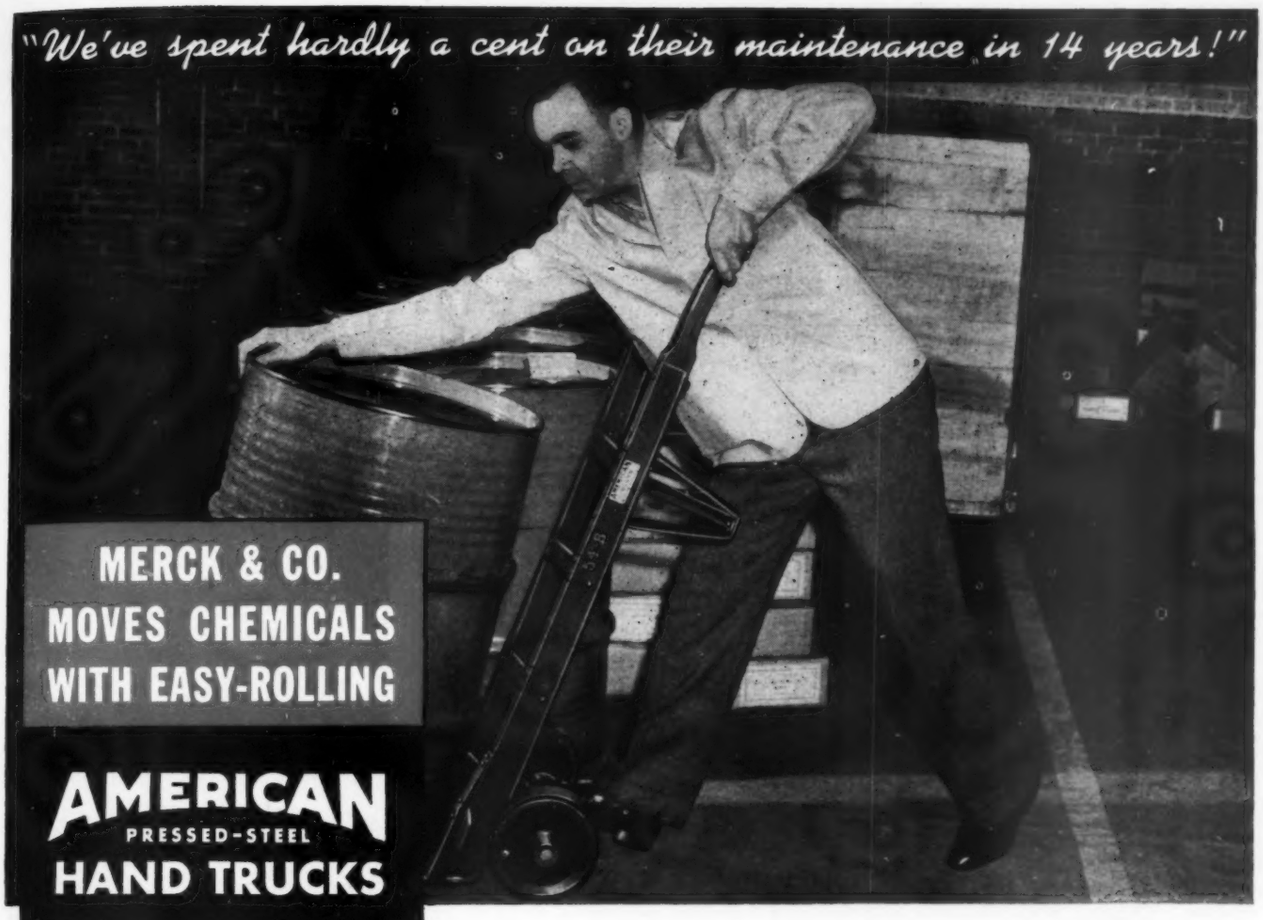
Blackout and shatter screen is a porous blanket made up of 16 layers of black flameproof expanded fiber and 4 layers of light colored flameproof expanded fiber.



This material is mounted in a light wooden frame and attached inside of windows, skylights, and door glass. It permits air to pass, yet stops broken glass, it is claimed. Research Products Corp., Madison, Wis.

Extinguisher for Magnesium Fires

It is claimed by the manufacturer that control of magnesium fires with MX Granules is simple and effective. When spread over the fire, granules soften, and



Ever since 1928, an expanding fleet of **American Pressed-Steel Hand Trucks** has been used for handling heavy drums, barrels and boxes of chemicals in the Rahway, New Jersey, plant of Merck & Co. Inc.

Loads weighing up to 500 pounds are readily handled by these balanced, easy-rolling hand trucks. According to Merck officials, the all-'round performance of their fleet of "Americans"... even the veterans, Class of '28, bought 14 years ago... is excellent!

Little or no maintenance expense... no splintering or breakage in the toughest service... not affected by chemical or atmospheric corrosion... that's the success story of **American Pressed-Steel Hand Trucks** in the spick-and-span Merck plants where more than 1500 fine chemicals are produced.

Users of **American Pressed-Steel Hand Trucks** in scores of other industries... in metal-working plants, textile and paper mills... in warehouses, on airports, railroad platforms and shipping piers... are equally enthusiastic. Truckers prefer "Americans" for their lightness, strength and ease of handling, with no down-time. Maintenance men hardly touch these sturdy hand trucks. They last for years, and years, and years!

Specify **American Pressed-Steel Hand Trucks**... cut your handling costs and speed your haulage. To choose the right trucks for your specific requirements, just write us for a free copy of Catalog T-42. Pictures and descriptions of hand truck models for every type of service.

This "American" Style B has a straight top cross bar, while the three lower bars are curved to accommodate barrels and drums as well as cases and miscellaneous packages.

The American Pulley Company
4240 WISSAHICKON AVE., PHILADELPHIA, PA.

Toilet Seat Covers? You are Paying for them NOW!

Get what you Pay for . . .

This washroom WASTE is now costing you MORE!

Save money by installing ONLIWON TOILET SEAT COVERS

—with the patented tab— self-disposing

ONLIWON TOILET SEAT COVERS are sterilized and packed to fit this dust-proof, sanitary wall dispenser. Only 5½" x 11". With the patented interfold only one is dispensed at a time and the cabinet can be kept filled without emptying. It is the truly economical way to dispense sanitary seat covers.

Your employes, especially those new to factory work, and the thousands of women now entering war industries are especially fearful of contracting disease from toilets used by others—and waste of washroom supplies results from their attempts to protect themselves.

A littered washroom is the signal for the next person to be even more wasteful and hundreds of employers have discovered that they were paying more than the cost of sanitary toilet seat covers without getting the benefits.

Installing ONLIWON Toilet Seat Covers prevents waste of toilet tissue, avoids the clogging of plumbing with paper towels and insures the utmost economy because only one seat cover is dispensed at a time.

Installing ONLIWON Toilet Seat Covers means clean and neat washrooms and the appreciation and confidence of your employes and less lost time.

ONLIWON Toilet Seat Covers are inexpensive to buy. Write today for name of nearby jobber who can supply you promptly. Address the A.P.W. PAPER CO., INC., Albany, N. Y.

ONLIWON

INTERFOLDED TISSUE

TOILET SEAT COVERS

Product of **A.P.W.** Albany, N. Y.

TRADE MARK REGISTERED IN U.S. PATENT OFFICE

seal the burning magnesium with an air-tight blanket, cut off the oxygen supply, and extinguish the fire. The same principle and methods apply to magnesium incendiary bombs. Granules may be applied to fires with ordinary shovel, or direct from container, without danger to operator; application does not result in objectionable smoke, soot, or toxic gases. Granules do not absorb an appreciable amount of moisture under normal atmospheric conditions and may be regarded as non-caking. The Philip Carey Mfg. Co., Lockland, Cincinnati.

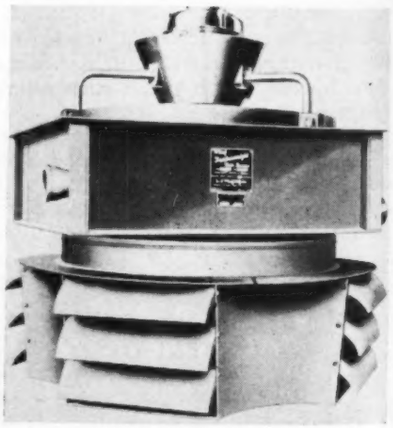
Utility Lantern

General utility lantern has an all-Tenite housing. Features an adjustable focal length and a small light bulb on an ex-

tension cord which may be used to illuminate objects not made visible by the larger beam. Tenite housing presents a surface that is non-tarnishing and rust-proof. Claimed to be light in weight, easy to handle, and yet virtually unbreakable, lantern is available in red, black, and olive drab Tenite. Focal Co., Downey, Calif.

Revolving Unit Heater

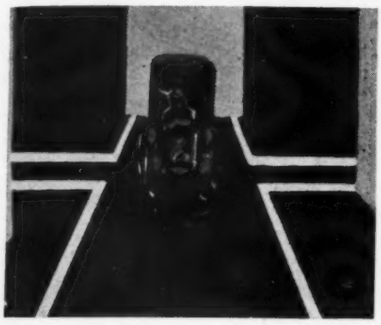
A revolving unit heater, with a variable discharge, is announced. Provision for adjusting the amount of heated air discharged from any side of the unit is incorporated in the discharge outlet, thus making possible heating a long, narrow



room or building with one revolving unit heater, the air streams being reduced and extended as the discharge outlets cover the sides and the ends respectively. Discharge from multiple outlets is effective in buildings or rooms with low ceilings. The additional number of outlets break up the discharge into slower but more closely spaced streams of heated air which circulate around obstacles and reach cold corners, it is claimed. L. J. Wing Mfg. Co., 160 West 14th St., New York.

Traffic Zoning Paint

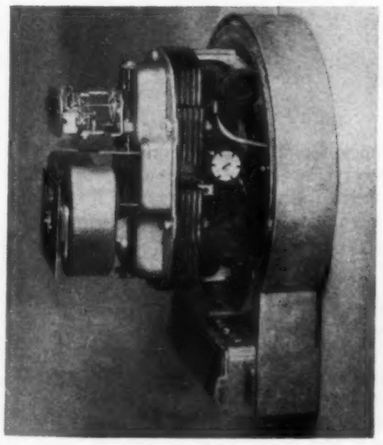
Porcelite traffic zoning paint is a marking paint especially formulated for factory floors and parking lots. This material, which dries for traffic in 15 minutes, has, according to the maker, shown resistance



to all types of traffic and maintained excellent visibility over long periods. Applicable by brush or spray, one coat of the product makes a clean, permanent, scuff-proof line on all types of interior or exterior surfaces. For creosote block, a special non-bleeding first-coater has been developed. Thomson-Porcelite Paint Co., 829 N. Third St., Philadelphia.

Switchboard Watthour Meters

Type CB meters are available with rear connection and stud terminals for use with instrument transformers or self contained up to 50 amperes, either projection



or semi-flush mounting. Meters up to 15 amperes for semi-flush mounting, except for the CB-32 and CB-38, can be changed to plug-in type.

Meters are complete with rectangular

GET MORE OUTPUT FROM NEW AND OLD MACHINES!

Keep present equipment operating at top efficiency and insure the best performance from new or revamped machines with Tannate flat leather belting.

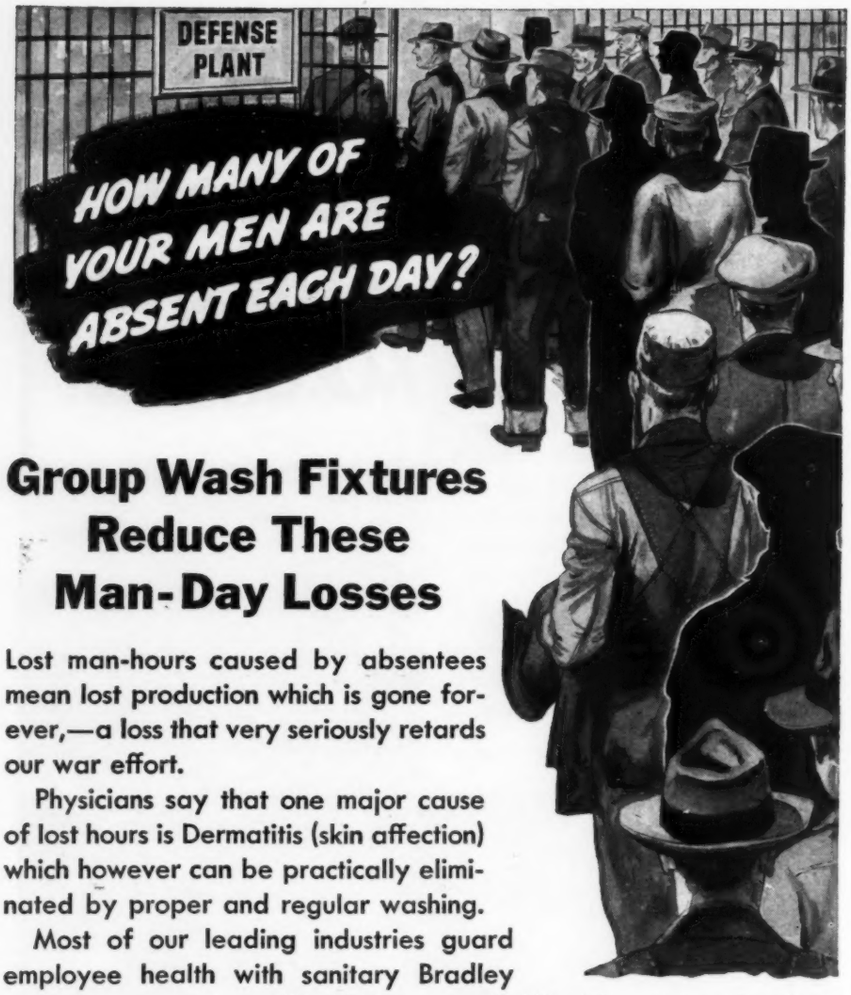
The unusual strength and firm pulley grip of Tannate keep machines running smoothly at full capacity even under varying load conditions. High temperatures (170°F. wet and 212°F. dry) moisture, machine oil and many weak chemicals have little affect on Tannate.

Let Tannate speak for itself with increased output, longer service-life, reduced costs. Why not give it a trial in your plant?

FREE HELP. Our new folder "Better Service Belt Hints" tells how to keep belts on the job with A-1 efficiency. Put a copy in the hands of every one of your men concerned with belting. No obligation.

J. E. RHOADS & SONS
35 North Sixth Street
Philadelphia, Pa.
Atlanta, New York
Cleveland, Chicago

STEP UP PRODUCTION with
RHOADS
Established 1702
Tannate
WATERSHED
LEATHER BELTING



Group Wash Fixtures Reduce These Man-Day Losses

Lost man-hours caused by absentees mean lost production which is gone forever,—a loss that very seriously retards our war effort.

Physicians say that one major cause of lost hours is Dermatitis (skin affection) which however can be practically eliminated by proper and regular washing.

Most of our leading industries guard employee health with sanitary Bradley "Multiple-person" Washfountains. Bradleys serve 8 to 10 persons simultaneously—supplying each with clean, sanitary running water from a central sprayhead.

Bradleys encourage regular and proper washing,—reduce wasted time in washroom.

Bradleys save workers' time. They cut installation costs and conserve critical metals, too, because an 8 to 10-person Washfountain requires but 3 piping connections, while 8 to 10 "single person" wash basins require from 24 to 30.

Our Washroom Consultants are ready to give you details and make helpful suggestions. "Washroom Plan Book" will be mailed on request. BRADLEY WASHFOUNTAIN CO., 2215 W. Michigan St., Milwaukee, Wisconsin.

BRADLEY *washfountains*

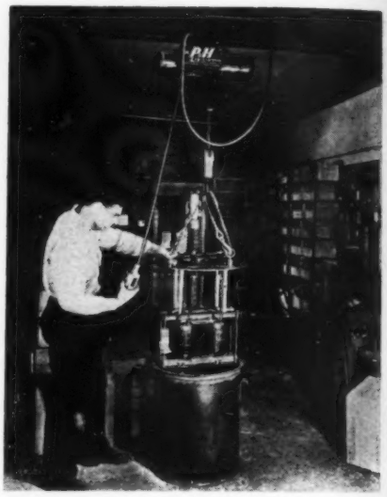
Critical Metals Saved

Not only has use of critical metals been cut 90%,—but base and big bowl are of pre-cast stone or marble. Piping connections are 80% less also where Bradleys are used.

cases and plug-in features, provided with automatic circuit-closing devices that operate when the meter is removed from the board. This eliminates service interruptions during inspection and maintenance, and short-circuit current transformer secondaries. Westinghouse Elec. & Mfg. Co., E. Pittsburgh.

Hoist

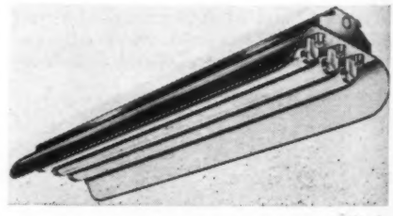
The one-ton Zip-Lift is equipped with full magnetic pushbutton control, preformed non-spinning hoist cables, 3-way



interchangeable mountings, safety-type limit switch, double brakes, features and dust- and weatherproof fully inclosed construction. Harnischfeger Corp., Milwaukee.

Fluorescent Fixture

Recessed and exposed fluorescent fixtures, made with reductions of 46 to 64 percent in quantity of steel required, are reported to be without appreciable reduction in effi-



ciency. Composition material replaces steel wherever possible, and is covered with a baked finish. Remaining metal sections are thinner than before. Day-Brite Lighting, Inc., 5411 Bulwer Ave., St. Louis, Mo.

Woman's Work Glove

Made of lightweight horsehide, this woman's glove will wear well and remain soft and flexible according to the manufacturer. Made in three sizes—small, medium, and large to insure fit and comfort. Has open back to provide coolness as well as flexibility. An elastic web band across the back keeps the glove snug. On the thumb and first two fingers is a patch. A 2-in. band of leather extends up over the wrist to provide protection

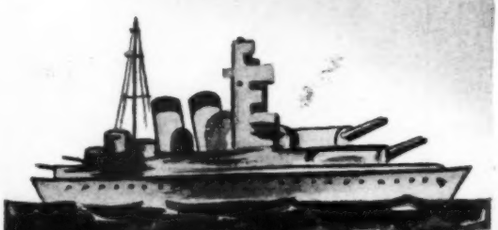
ON LAND AND SEA AND IN THE AIR

men are risking their lives to safeguard the nation's life and the ways of liberty.

To deprive them of anything necessary in their fight for these aims is unthinkable.

That they may not be deprived of rubber, a vital necessity to them, you, its distributors and dealers, are called on to sacrifice a substantial amount of your regular civilian needs.

In war, morale is as important as material. We know that you have contributed both and will continue to do so until the battle for liberty is won.



BOSTON WOVEN HOSE & RUBBER COMPANY

CAMBRIDGE, MASS.

12 anti-friction bearings—a bearing at *every* rotating point!

Only the high speed Cyclone hoist gives you *eight* ball bearings and 4 roller bearings...4 or 5 times as many as are used in any comparable hoist. The result: 50% less friction, assuring easier and faster operation, longer life and increased production.

Serving industry in countless applications, more than 100,000 Cyclones have proved the extra value of their many exclusive features including ...added safety from the smooth gyrating yoke action...internal guides to prevent load chain slippage...accurate meshing of machine cut gears ...shielded lift wheel...positive grease-bath lubrication.

***CM* materials handling equipment includes hand power and electric hoists, cranes and trolleys—a type for every service. Ask your mill supply distributor, or write us, for a *complete, illustrated CM* Catalog.**

CHISHOLM-MOORE *Hoist* CORPORATION

(Division of Columbus-McKinnon Chain Corporation)

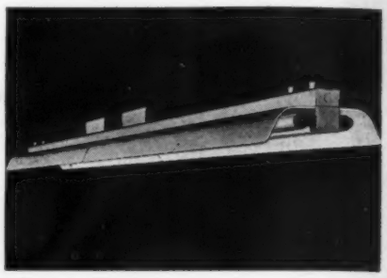
130 FREMONT AVE. TONAWANDA, N. Y.

***Branch Offices:* NEW YORK • CHICAGO • CLEVELAND**

for that vulnerable spot. This glove, No. 14,640, may be purchased in pairs, all rights, all lefts, or any combination of rights and lefts. Industrial Gloves Co. Danville, Ill.

Non-Metallic Fluorescent Unit

Fluorescent industrial units with non-metallic reflectors employ CurtiStrip wiring channel and are for two or three 40-watt lamps or two 100-watt lamps per reflector. Eight- or 10-ft. sections may be



joined for continuous runs of any length, or reflectors may be omitted without interfering with the continuous wireway. Ballasts and starters are mounted on top of the CurtiStrip, making them readily accessible at any point.

The reflector is Fluracite which, according to the manufacturers, is a tough white synthetic finish that does not discolor and provides a smooth surface of high reflectivity for the non-metallic material of which the reflector is fabricated. Fluracite is easily cleaned with soap and water. Curtis Lighting, Inc., 6135 W. 65th St., Chicago.

Foot Treadle Switch

Two models, No. 4141-D, double action, and No. 4141-S, momentary contact, of foot treadle switches are announced. Known as Linemaster, switch is fully en-

closed and hooded for protection against dirt and chips. Snap action is claimed to be extremely rapid and arcing is kept at a minimum. Switch is adaptable to knee action also. Simmonds Machine Co., Southbridge, Mass.

Sheaves

Speed variations from 66 to 116 percent of normal are possible with the wide-range sheave, recently added to the regular line of Texrope Vari-Pitch Drives. Sheave is used with a companion sheave grooved for wide V-belts. Manufactured in sizes to fit the shafts of all standard NEMA motors,

To industries converting to war production where magnet wire and coils are vital . . .

Anaconda Can Help!...

Anaconda's Central West plants still have unfilled capacity on magnet wire and coil production . . . *for war work.* In addition to these facilities, they have experienced personnel to help solve problems you might have with this phase of manufacture.

Here is an opportunity to release your time so that it can be devoted to other important problems. Our sales offices, located in all principal cities, are near you. Call today. A representative will be glad to discuss your problem.

GENERAL OFFICES: 25 Broadway, New York City
CHICAGO OFFICE: 20 North Wacker Drive
Subsidiary of Anaconda Copper Mining Company
Sales Offices in Principal Cities

ANACONDA
from mine to consumer
This familiar trade-mark symbolizes the best efforts of modern research and production.

These Improved Insulations Are Now Available
Nylon—Vitrotex—and Formvar

The commercial development of Nylon and Vitrotex insulations is in part the result of Anaconda research . . . research that continues with redoubled effort producing new products for war work. Of course, when peace comes, the benefits of this research will be ready for industry everywhere.

42263

Magnet wire and coils

ANACONDA WIRE & CABLE COMPANY

TRAPPED by Light!

There is no getting away from it! To combat the increasing threat of sabotage, properly planned floodlighting installations leave no room for side-stepping. They become "light traps" which prevent approach to vulnerable areas—or escape from them.

Guarding the plants which make America strong is one of the many ways Goodrich Industrial Lighting serves the nation today.

ELIPSO STANDLITE

A typical Goodrich development in lighting. Provides a veritable barrier of light through which intruders cannot penetrate without immediate detection by guards or watchmen. Finished in permanent porcelain enamel and completely weatherproof. Literature on request.

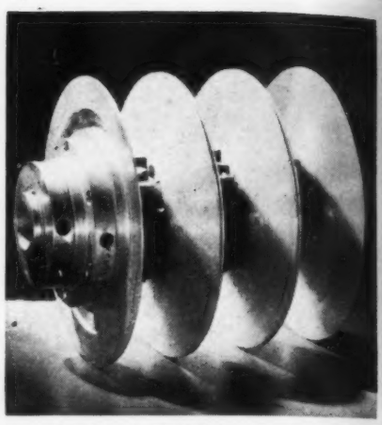
Protecting vital plants with floodlighting—saving man-hours in production—Goodrich industrial fixtures are serving America's war effort everywhere.

SOLD ONLY THROUGH ELECTRICAL WHOLESALERS

GOODRICH ELECTRIC COMPANY

OFFICES IN ALL PRINCIPAL CITIES

GENERAL OFFICES AND FACTORY: 4604 BELLE PLAINE AVENUE, CHICAGO, ILL.



from fractional to 30 horsepower. Especially adaptable in textile mill and machine tool applications, according to the manufacturer. Allis-Chalmers Mfg. Co., Milwaukee.

Insulating Varnish

Glasbinder, Type G, can be used for binding cotton, glass, or asbestos fibers, or for coating tape. It is made entirely from American raw materials. Claimed to have high values of elasticity, heat endurance, breakdown (1520 volts per mil after 50 hours in water), resistance to oil and to abrasion (5300 revolutions on test). Insulating Varnish Div., William Zinsser & Co., Inc., 516 59th St., New York.

Air Raid Barrel Truck

Barrel pump extinguisher consists of a 20-gal. barrel, mounted on wooden wheels. Can be trundled to the place of use. Handles are attached so two people can carry it. The barrel is fitted with watertight hinged cover, stirrup pump, 12 feet

of hose with a nozzle, and an axe.

Advantages claimed for this type of extinguishing equipment include its easy portability to the point of use, its simplicity of assembly, its greater water capacity, its ease of storage in corners of industrial and other buildings.

Assembly is painted bright yellow. On the front of the barrel are the letters "For Air Raid Use Only." Sand barrel of 2½ cu. ft.-capacity is equipped with wheels,

Your Foremen and Workers Need these 3 Services..... NOW!

Brains are Ammunition — too! But brains are not like a machine. You can't turn them on and off with a switch. Thousands of companies, large and small, are using these three services to instruct and inspire their workers and to tap the hidden resources of these workers' minds.

(1) Management Information

—for Foremen, Supervisors and Department Heads. A 4-page, weekly bulletin edited by Glenn Gardiner and a group of practical operating executives who are facing vital industrial problems every day.

A 10-point rotating subject program covers the following vital topics in an interesting, non-technical manner: 1) Handling People; 2) Control of Costs; 3) Waste Reduction; 4) Maintenance of Quality Standards; 5) Prevention of Accidents; 6) Organization Relations; 7) Training and Instructing; 8) Practical Job Relations; 9) Improvement of Methods; 10) Self-Improvement.

Even your best foremen need constant review on these subjects. Send for a copy and see for yourself how clearly, interestingly and forcefully these dynamic bulletins get their messages across.

(2) Industrial Bulletin Board Service

—provides constructive displays and messages with frequent patriotic appeals that will keep your workers on their toes and keyed up to produce at peak capacity. It gives you:

1. An attention-getting, up-to-the-minute news picture daily—a forceful magnet that attracts your workers to the Bulletin Board each day.
2. Display Posters — THINK-Stimulators — on all phases of Production, Conservation, Accident Prevention, Quality Workmanship, Absenteeism, Waste Reduction and Morale. (Size 17" x 22").
3. A medium for intimate, friendly messages and news from Management to workers.

This is a tried and tested plan for keeping your workers keyed up to the present War tempo.

(3) Employee Suggestion Service

—"Fight With Ideas." The War Production Board has asked Industry to enlist the aid of all workers by getting them to submit their suggestions for Improving Quality, Increasing Production, Conserving Material, Increasing Tool Life, Saving Time, and Preventing Accidents.

This Suggestion Service is a simple, practical plan which makes it easy for your workers to offer suggestions. It approaches them from all angles of their self interest—patriotism—desire for recognition — loyalty to the Company — urge to take a more active part in this production effort. It will make them THINK and REASON and ACT.

You can't afford to pass up this storehouse of ideas that lie in the minds of your workers.

Have your secretary write for full details of the services in which you are interested. TODAY!

Elliott Services to Industry

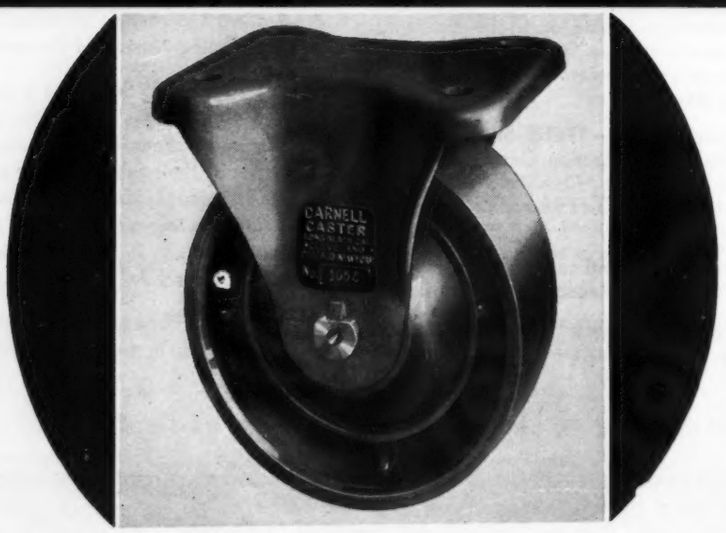
ELLIOTT SERVICE COMPANY, 219 East 44th St., NEW YORK, N. Y.

Established 1911

DARNELL
CASTERS & WHEELS

Darnell Double Ball-Bearing Casters and E-Z-Roll wheels reduce floor wear to a minimum, lengthen the life of equipment and increase the efficiency of employees—Write for 192 page Darnell Caster and Wheel Manual.

DARNELL CORP. LTD., 60 WALKER ST., NEW YORK, N.Y.
LONG BEACH, CALIFORNIA, 36 N. CLINTON, CHICAGO, ILL.



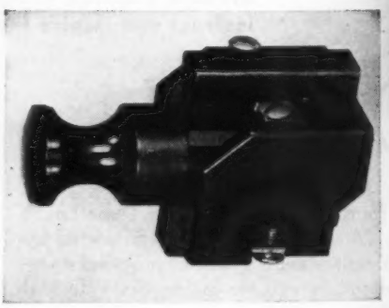
handles, long-handled shovel, and axe. Specialties Manufacturing Co., Inc., 35 Farrand St., Bloomfield, N. J.

Explosion Proof Timers

An explosion-proof time delay relay, Type TDIC, is laid out for panelboard mounting with the setting knob and dial projecting. Within this housing it is feasible to mount a timer or timer and small relay. The latter construction would be used where it is desired to control the timer from remote momentary start button. The R. W. Cramer Co., Inc., Centerbrook, Conn.

Pull-Push Button Stations

Increased safety and economy are claimed as features of a pull-push control button. A single button for stopping and starting is natural. The normal position is in the center, and requires definite action to move it momentarily in either direction from the center. The button is pushed to stop the motor, but it must be willfully pulled to start. Since pushing the button can only stop the motor, it "fails safe" when hit or accidentally pushed. The Arrow-Hart & Hegeman Electric Co., 103 Hawthorn St., Hartford, Conn.



Center Control Truck

An electric-powered truck, with front-wheel drive and rear-wheel steer, handles up to 4000 pounds and travels up to 5 m.p.h. with full load. Tilting uprights are 83 inches high when telescoped and can be extended to 140 inches. Forks on a rotating base are capable of making a complete revolution, but the base can be provided with stops to limit the swing to any angle up to 180 degrees.

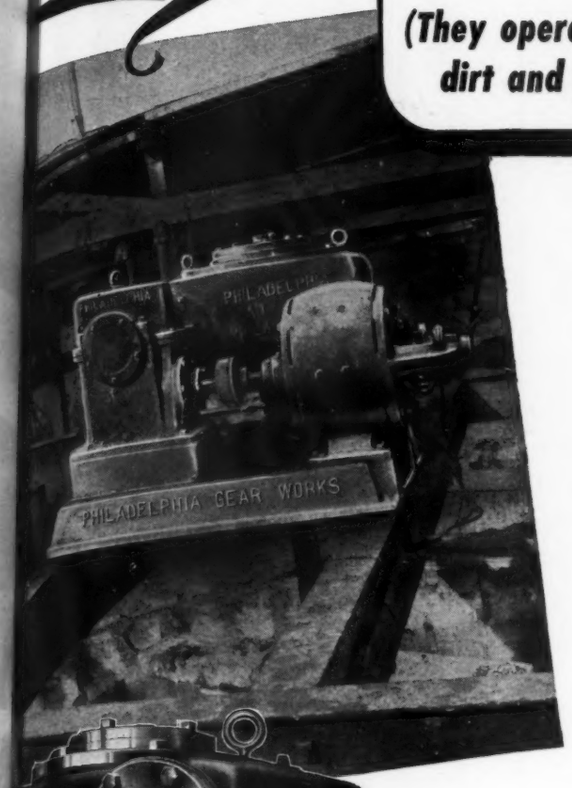
At top position, forks carry either sus-

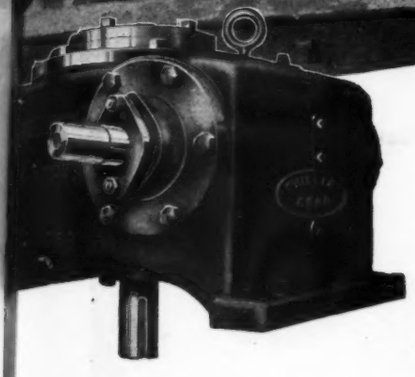
Philadelphia WORM GEAR Speed Reducers

you said:

(illegible)

(They operate efficiently even where dirt and moisture are problems.)





Above — Horizontal and vertical type Philadelphia Worm Gear Speed Reducers installed at a glue works. Left—a vertical type Philadelphia Worm Gear Unit.

Philadelphia Worm Gear Speed Reducers are constructed to withstand practically any operating condition. They are rugged, insuring long life, and will transmit power with efficiencies as high as 85% to 95% with little if any maintenance attention except occasional lubrication.

Their compact design saves valuable floor space.

Philadelphia Worm Gear Units are made in horizontal and vertical types and in a wide range of horsepowers and ratios that meet almost any drive requirement. Further information about them will be sent on request.

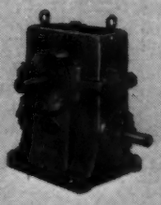
PHILADELPHIA GEAR WORKS

INDUSTRIAL GEARS AND SPEED REDUCERS LIMITORQUE VALVE CONTROLS

ERIE AVENUE & G STREET PHILADELPHIA, PA.
New York, Pittsburgh, Chicago

***Philadelphia* LIMITORQUE CONTROL**
operates all types of valves, etc., safely, economically, from convenient stations.

***Philadelphia* GEARS**
All types and sizes of industrial gears. Can be supplied in all materials.



***Philadelphia* WORM GEAR SPEED REDUCER**
right angle drives — vertical or horizontal. Wide range of ratios and horsepowers.

***Philadelphia* MOTOREDUCER**
The economical self-contained drive, Horizontal or Vertical types — various ratios and horsepowers.

***Philadelphia* HERRINGBONE SPEED REDUCER**
for heavy loads at high speed. Single, Double, Triple Reductions, various ratios and horsepowers.

PRODUCTION
and
PROTECTION

M&H

VALVES
HYDRANTS
and
PIPE LINE
ACCESSORIES

The high quality and dependability of M&H products play an important part maintaining maximum production of war materials in many manufacturing plants. M&H products are equally important for adequate protection of plants and factories against the increased fire hazard of war emergencies. A reserve supply is good insurance.

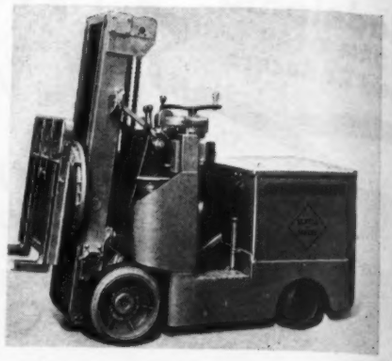
M & H GATE VALVES are cast iron body, bronze mounted, with double-disc parallel seat or solid wedge top, non-rising stem or outside screw yoke. They come either with flanged or screwed connections. Valves for fire protection lines are approved by both the Underwriters and the Associated Factory Mutuals.

M & H FIRE HYDRANTS are revolving head, dry top, bronze mounted. They also are approved by Underwriters and Associated Factory Mutuals. Entire main valve assembly is removable through barrel without digging. Special Traffic Model is fitted with breakable bolts and stem coupling, designed to break at ground line under impact. Repairs are made simply by renewing bolts and coupling without shutting off the water.

M & H PRODUCTS INCLUDE

FIRE HYDRANTS	SHEAR GATES
GATE VALVES	MUD VALVES
TAPPING VALVES	VALVE BOXES
WALL CASTINGS	FLAP VALVES
SPECIAL CASTINGS	SLUDGE SHOES
TAPPING SLEEVES	FLANGE AND FLARE FITTINGS
CHECK VALVES	FLANGED FITTINGS
FLOOR STANDS	B & S FITTINGS
EXTENSION STEMS	
CUTTING-IN TEES	

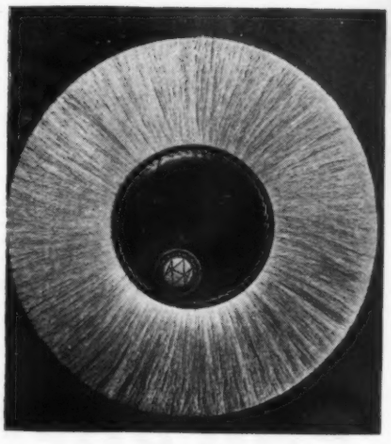
M & H VALVE
AND FITTINGS COMPANY
ANNISTON, ALABAMA



pended or supported loads; when locked into places at the bottom, they handle pallets or low skids with no adjustment. Forks are interchangeable with rotating apron to pick up or deliver roll on end or side. Travel brake is foot-operated. When operator steps from his position on the truck, power is shut off and the brake applied automatically. The Elwell-Parker Electric Co., 4000 St. Clair Ave., Cleveland.

Brushes

Wire and tampico brushes for cleaning, polishing, and finishing metals are made with fiber flanges and called Staplbond. The flanges are fastened with tinned steel wire staples. Wheel brushes are $\frac{3}{8}$ or $\frac{1}{2}$ inch thick and from 8 to 18 inches in diameter. The arbor hole can be punched as needed, and wheels up to a 6-in. face



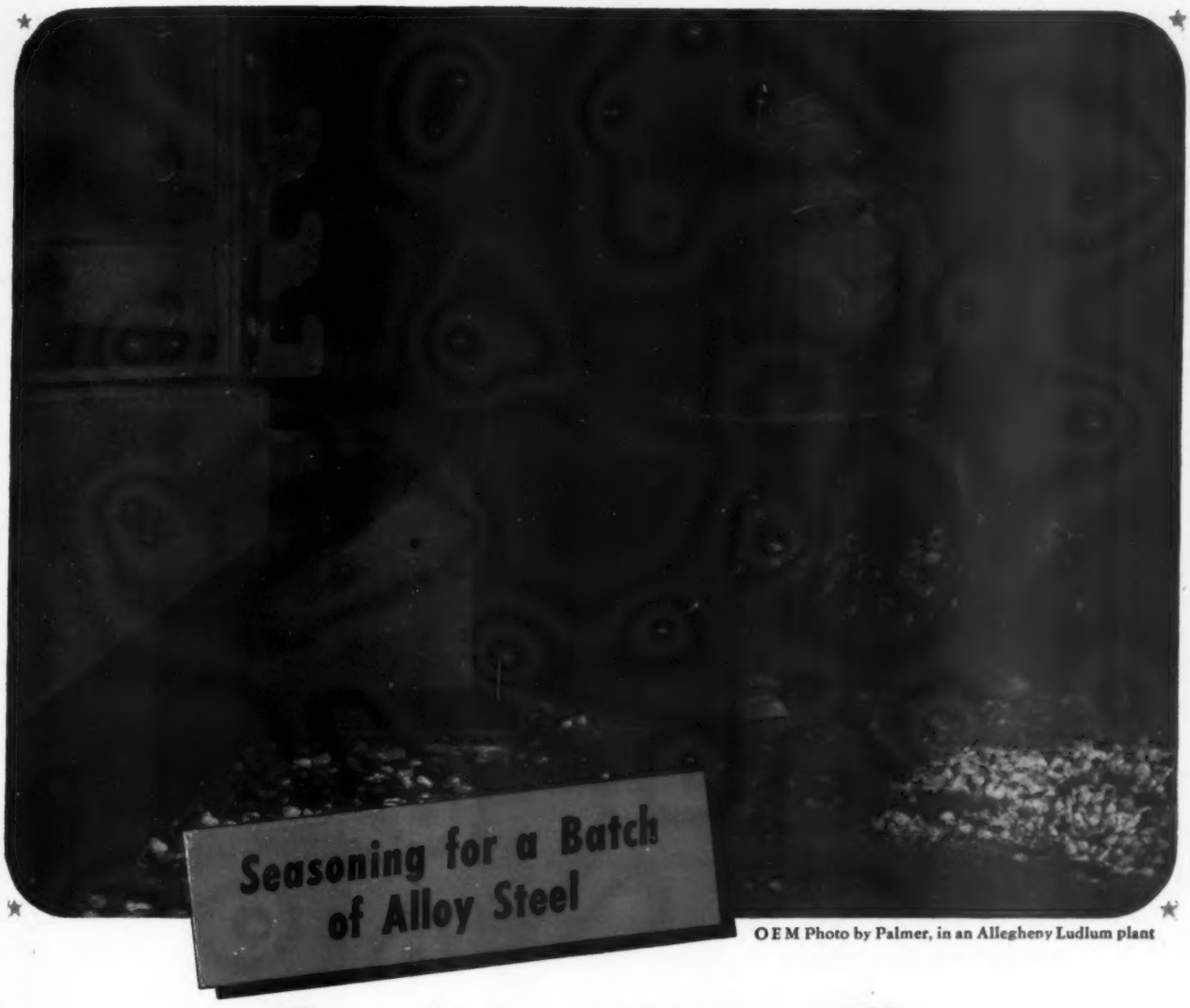
obtained by gang punching and trimming. Hanson-Van Winkle-Munning Co., Matawan, N. J.

All-Spray Nozzle

A water spray nozzle, the "Alfcospray," has been introduced. From shutoff a slight turn of the tip immediately gives a cone spray of 40 degrees. Further rotation produces increasing cones up to full curtain of 150 degrees, with reversal back to shutoff without intervening straight stream. Prevents possibility of a solid water stream being applied on live electric circuits.

The nozzle, known as Model 10F, can be furnished for any $2\frac{1}{2}$-in. hose thread, Underwriters' tip thread, 2-in. hose thread, or $1\frac{1}{2}$-in. thread.

The 40-deg. spray capacity is about 95



O E M Photo by Palmer, in an Allegheny Ludlum plant

. . . But Not to Hitler's Taste

WAR'S emphasis is on *strength,* in men and in steel. That trite little truism is all pictured for you above, where the last admixture of alloys is going into an Allegheny Ludlum electric furnace.

In the shortest possible time after the arc is struck, that batch of alloy steel will be war material in use. It may be stainless bomb racks or ammunition chutes; tool steels fashioning a tank; valves or nitrided shafts in engines; electrical steels in gun and engine controls. Whatever it is, Hitler definitely won t like the taste of it. Nor will Tojo.

But let's make sure it takes the least amount of time to turn out these finished war goods. And let's not waste, unnecessarily, a single pound of vital alloys in the process.

To help engineers and production men toward more efficient fabrication and use of alloy steels, and to aid in the instruction of training classes, we have developed a wide list of printed aids. They're especially valuable for assisting "conversion" plants to avoid pitfalls and get under way. Just tell us your alloy steel problems, and let us help you find the answers.

Allegheny Ludlum
STEEL CORPORATION
GENERAL OFFICES: PITTSBURGH, PENNSYLVANIA

ADJUSTABLE

TO PEAK PRODUCTION

VEELOS . . . the Link V-Belt!

ONLY **an adjustable V-Belt fully meets the demands of today's production emergency . . . and Veelos is the *ONLY* quickly adjustable V-Belt.**

1 ADJUSTABLE TO CONSTANT OPERATION. Even if a bomb fragment ripped a Veelos drive, any strand could be replaced in the bat of an eye! Veelos in rolls guarantees machine production . . . reduces machine downtime!

2 ADJUSTABLE TO MAXIMUM OUTPUT. Link construction provides quick, easy tension adjustment to end slippage . . . permits operation of machine at maximum rated capacities.

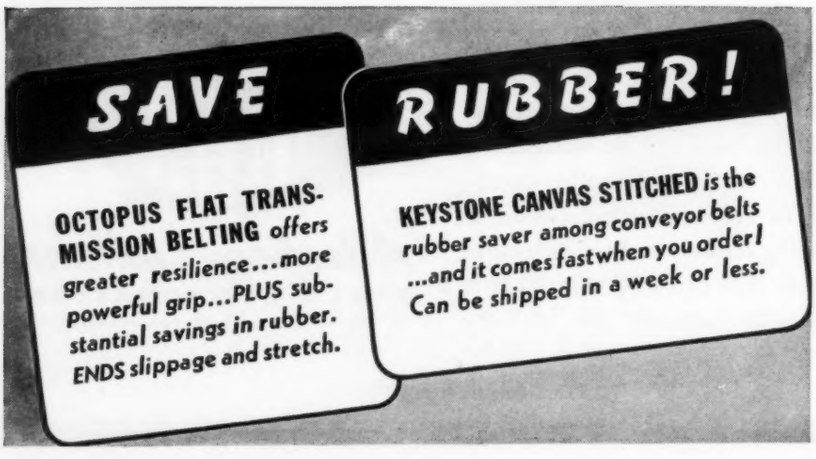
3 ADJUSTABLE TO DELIVER FULL POWER. Equalized tension on *all* strands can readily be maintained, therefore *all* strands are constantly at work delivering full power.

VEELOS USES LESS RUBBER PER DRIVE!

Veelos sales engineers . . . especially trained in power transmission work are now "Production Wardens." Let one tell you how Veelos can help you adjust *your* production to higher figures!

MANHEIM MANUFACTURING & BELTING CO., MANHEIM, PA.

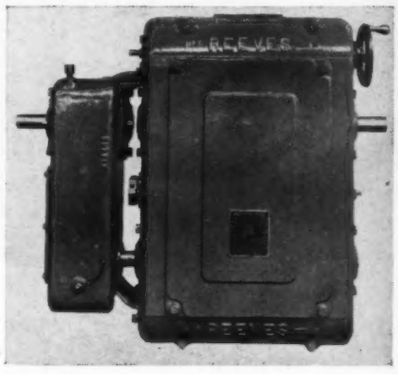
VEELOS V-BELT
ADJUSTABLE to any length
ADAPTABLE to any drive


SAVE
RUBBER!
OCTOPUS FLAT TRANSMISSION BELTING offers greater resilience...more powerful grip...PLUS substantial savings in rubber. ENDS slippage and stretch.
KEYSTONE CANVAS STITCHED is the rubber saver among conveyor belts ...and it comes fastwhen you order! Can be shipped in a week or less.

g.p.m. and 135 g.p.m. at 50-lb. and 100-lb. water pressures respectively. Full curtain capacity at these pressures is about 170 and 215 g.p.m., according to American-LaFrance-Foamite Corp., Elmira, N. Y.

Variable Speed Transmission and Reducer

A Reeves variable speed transmission, inclosed design, equipped with built-in chain reducer, and with the output shaft in exact alignment with the input shaft is



available. Output speeds are infinitely variable, within predetermined limits, by turning the speed control handwheel. Chain drive operates in a bath of oil.

Unit illustrated is for vertical operation with oil drain and filler located accordingly. Reeves Pulley Company, Columbus, Ind.

Voltage Regulator

A sensitive electronic voltage regulator which regulates the output voltage of a.c. and d.c. generators is announced. Output voltage of generator must extend 46 volts. Unit operates from a three-phase a.c. power supply and acts as a grid-controlled rectifier to supply d.c. field current to generator, or exciter of generator, being regulated. Sensitivity is plus or minus ¼ percent when a.c. supply voltage does not vary more than 5% from nominal rating.

Regulator is built on a Micarta panel one inch thick and is designed for master panel mounting. No inclosing cabinet is provided but the tubes are protected by a screen cover.

Manufacturer claims features of the

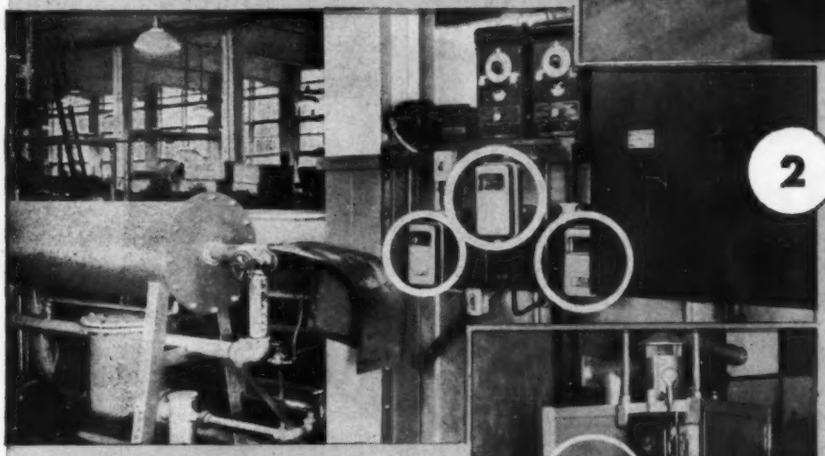
Here's how

TIME SWITCHES CAN BOOST YOUR PRODUCTION

THEY prevent lost time by having electric heating equipment ready for use when workers arrive.

This time switch turns on a solder pot to bring it to correct temperature before the start of the working day. It also turns the pot off automatically at the end of the day.

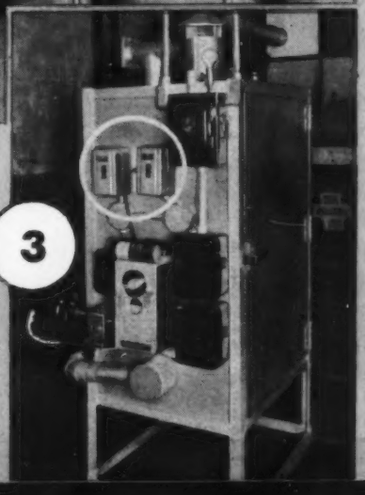
1



2

THEY automatically time intricate processes, permitting operators to give full attention to productive work.

The entire operation of this chain-conveyor annealing furnace is controlled by three time switches. They turn on the heating elements, start the motor-driven chain, turn water on for the gas mixer, and turn it off after the mixer has been shut off — all in a carefully timed sequence of operations.



3

THEY complete, after working hours, processes that were started at the end of the day.

Here small coils are dried after dipping. One time switch starts an exhauster. A second switch turns the heater on—and off when drying is finished. The furnace can be loaded at the end of the day and the coils dried after working hours — thus completing an extra batch.

THESE are but a few of the many jobs G-E time switches are handling. The best part of it is that they're inexpensive, easy to install, and easy to adjust. It will pay you to check your own processes, and make a note of those that can be controlled automatically. Then ask the nearest G-E office to recommend the time switches best suited. General Electric, Schenectady, New York.

GENERAL ELECTRIC

Don't Let NOISE Cut Office Efficiency!

WHAT'S WRONG WITH MY EARS, ANYWAY?
Guess the boss can't talk any louder
Did he say 'priority' or 'majority'?
WHY DON'T THEY CLOSE THE PLANT DOOR?
Does Jones have to shout on the phone!

Install a J-M Acoustical Treatment!

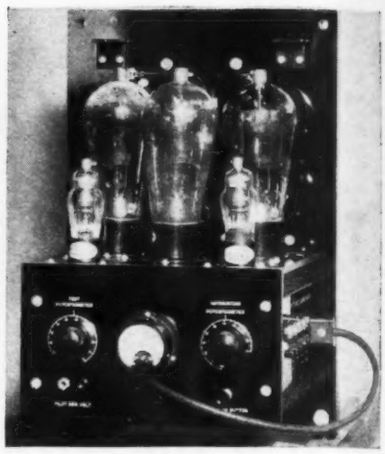
A SERIOUS HANDICAP even in normal times, uncontrolled noise has no business in a plant office today. It lowers efficiency, slows up output, can even sabotage an entire production program!

You can eliminate any such trouble quickly, easily and at low cost, with a Johns-Manville Acoustical Treatment. Ideal for plant offices, J-M Acoustical Materials effectively absorb disturbing noise. Applied with little if any interference with routine, they are fireproof, rotproof, durable, easy to clean. And they quickly pay for themselves in increased efficiency, reduced errors and improved morale.

FOR COMPLETE DETAILS, write for J-M Sound-Control Catalogue AC-26A. Johns-Manville, 22 East 40th Street, New York, N. Y.

JOHNS-MANVILLE

SOUND-CONTROL MATERIALS AND ACOUSTICAL-ENGINEERING SERVICE

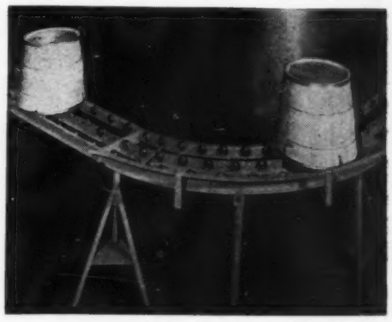


DT-5 are low maintenance, reliability of operation, and a high degree of regularity. An anti-hunt circuit is built into the regulator which prevents the regulator from overshooting when close regulation is required. Westinghouse Elec. & Mfg. Co., E. Pittsburgh.

Portable Conveyor

Constructed in 10-ft. sections, quickly coupled for any length, portable conveyor simplifies and speeds loading or unloading of trucks and boxcars, it is claimed. Also useful for transferring packages to and from stockrooms and warehouses.

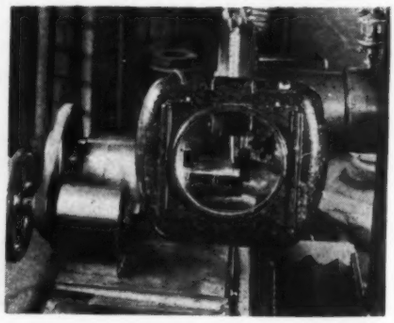
Sections are available with wheels or rollers, and are supported at intervals on



easels or tripods. Easels fold for access into narrow spaces. Tripods permit a height adjustment of 12 inches. Quickly set up or taken down. No tools required. E. W. Buschman Co., 418 New St., Cincinnati.

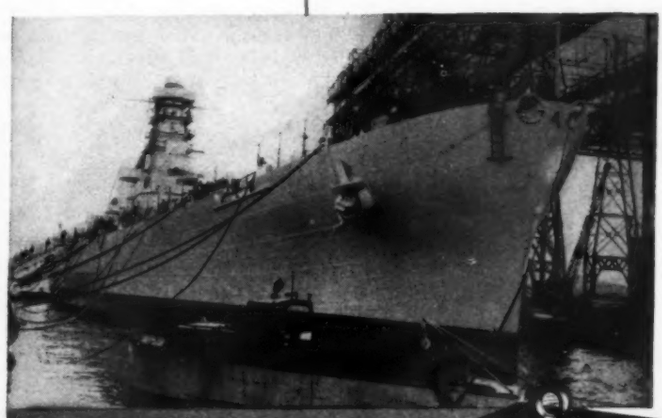
Magnifying Lens

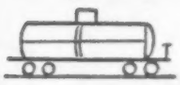
Four models of Super-Sight adapted to close inspections, small parts assembly and precision machining are announced. No. 95ZC, for inspection, has two magnifying



"Simplified" Arc Welding

...has won important victories for Uncle Sam.





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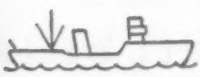

Hundreds of new all-welded tankers are pouring off the ways in world record time . . . indirectly; it's Hobart's answer to the Axis.

Important weapons of actual combat are now rolling off the lines at unheard of speed; thanks to arc welding... particularly Hobart "Simplified" Arc Welding.

Hobart can help you do your part. Why not investigate today?

HOBART "Simplified" ARC WELDERS

with the exclusive and original REMOTE CONTROL

A New Handbook of "Practical Arc Welding"—A ready reference manual on every phase of welding. Will help you with production. Order for key men and operators today. **$2.00** Postpaid

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Please send information on items checked.

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☐ Also send_____copies "Practical Arc Welding" at $2 each, postpaid
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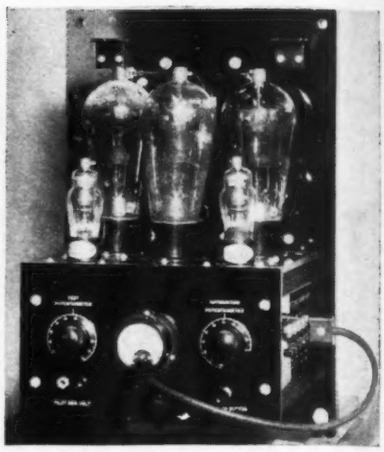

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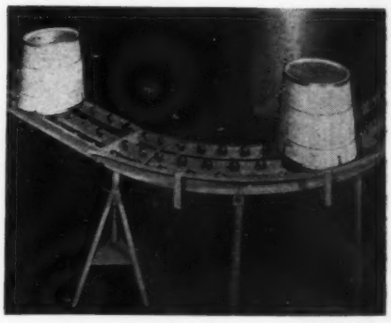

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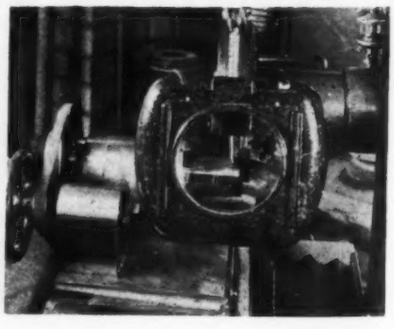

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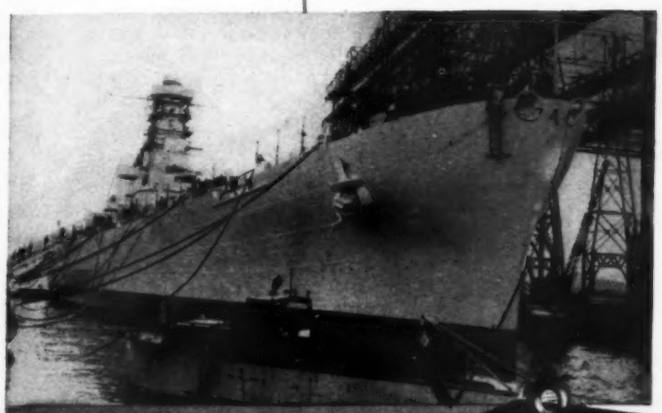

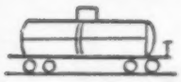

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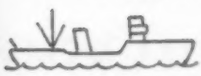

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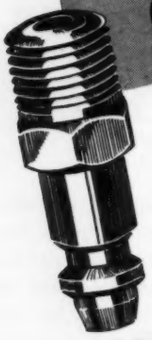
Whether it's Production to Meet...

WAR DEMANDS OR COMPETITION



HANSEN

Push-Tite

AIR HOSE COUPLINGS

WILL DELIVER

They're faster, far more economical, no wastage of air, easier to operate, no leakage from an ounce of pressure up to well over 14,000 pounds, longer life, trouble free operation. Slight push of plug into socket it is connected absolutely air tight, air is automatically turned on. There is no turning of air valve, connection or hose. Easy pull back on sleeve and plug is ejected, disconnected and air is automatically turned off. Is it any wonder they are the talk of the trade and the choice of most of the big industrial plants thruout the country.

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Hansen MFG. CO.

INDUSTRIAL AIR LINE EQUIPMENT

1786 E. 27TH STREET • CLEVELAND, OHIO

lenses (top lens 5, lower lens 4 inches), lower lens adjustable to proper focus—lenses lighted separately. Head is balanced to bracket and can be instantly put in any position over a wide bench area. No. 89ZC, for inspection, small parts assembly, and bench work, has one magnifying lens (5 inches), head balanced to bracket enabling its use over a wide bench area. No. 89U, for precision machining, has one magnifying lens (5 inches); fitted with safety lens to protect magnifying lens when required. No. 44ZC, for bench work and small parts assembly, has one magnifying lens (4 inches); head balanced to bracket and can be used in any position over a wide bench area. The Boyer-Campbell Co., 6540 Antoine St., Detroit.

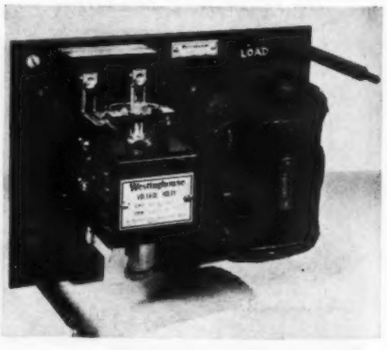
High Bay Lighting Unit

Unit known as Sterling No. 5526, lighting unit consists of a silvered glass reflector and Lite-Flo Stipple in a metal housing with adjustable porcelain socket.

provides air passage between the housing and the reflector, permitting circulation both inside and outside the reflector, which keeps temperatures at a minimum, it is claimed. Sterling Reflector Co., 1431 W. Hubbard St., Chicago.

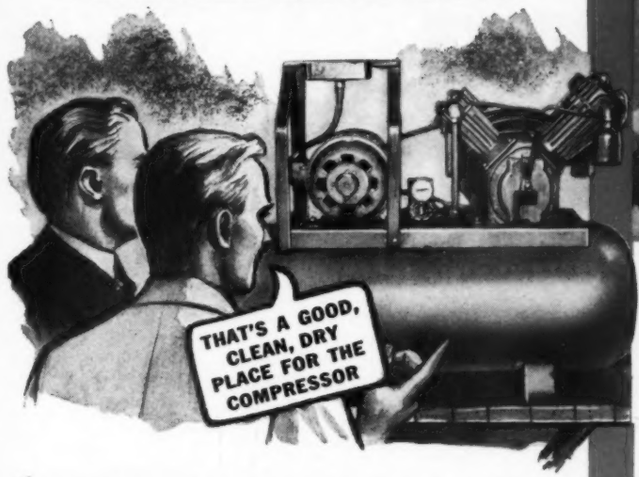
Automatic Synchronizers

Automatic synchronizer, type XK, for automatically synchronizing small generators, is announced. Limited in use to a.c. machines having a kva. rating of 250 or below and a voltage rating of 600 or less,

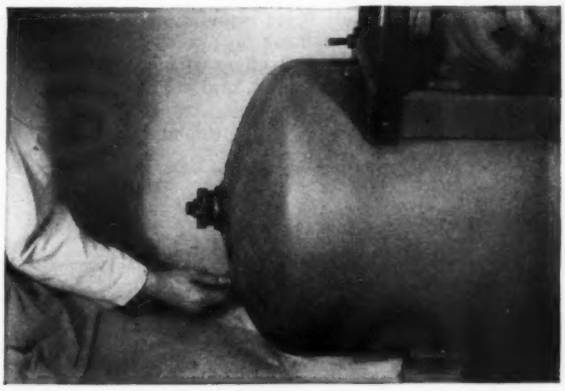


DON'T LET NEGLECT SABOTAGE YOUR VITAL LUBRICATION EQUIPMENT!

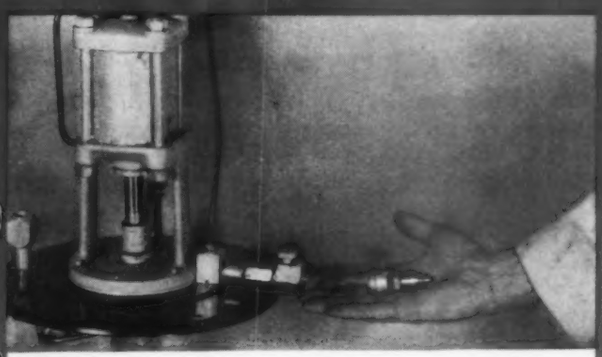
These Five Simple Precautions Can Add Years to the Life of Pneumatic Grease Guns!



1 MOISTURE OR GRIT NEAR COMPRESSOR MEANS NEEDLESS WEAR ON YOUR PUMP!
Air compressors should be placed where air is clean and dry. Avoid basements, other damp places, or location near a grinder or other source of dust and grit. Moisture and foreign particles damage pump, cause trouble.



2 TANK SHOULD BE DRAINED WEEKLY!
Condensation in the air line cuts leather, scores cylinder, and causes deterioration of hose. Air tank should be drained *at least once a week!* A petcock is provided for this purpose. This task takes little time, saves much trouble.



3 CLEAN FILTER SCREEN EVERY MONTH!
There is a filter screen at the oiler in most air-operated pumps. This should be cleaned every month, or oftener, to avoid having foreign particles clog the air inlet. Ample air volume at all times is essential to efficient performance. (Be sure your air lines are of sufficient size for your needs.)

4 OIL YOUR PUMP EVERY DAY!
Your air-operated grease pump requires regular lubrication, just as any other machine does. Oil it every day with a medium grade of oil—to insure longer life, to preserve couplers and air valves.

5 CHECK OFTEN FOR AIR LEAKS!
Compressed air is a commodity not to be wasted. Wasted air pressure is wasted power. Audible leaks may require reseating air valve, replacing gaskets or cup leathers to correct sluggish performance of air-operated equipment.

Alemite engineers want to help you get the most out of your vital lubrication equipment. Write to us about any maintenance, repair, or service problem. There is no obligation!

Ask Anyone in Industry!

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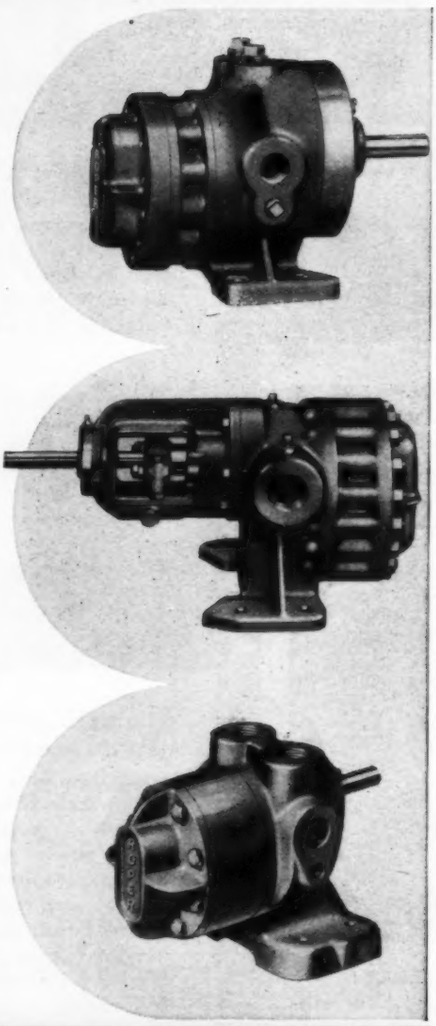
FROM STANDARD MODELS

Pick your pump from the Roper line which offers hundreds of installation possibilities. Whether you require pumps for the operation of hydraulic mechanisms, lubricating systems or general transfer work, there are standard model Ropers that will do the job. From the wide variety of Roper models with nearly every conceivable capacity, pressure, speed, drive, mounting and piping arrangement it is easy to select pumps that are practically "made-to-order" for your needs.



3 SERIES OF PUMPS

Capacities from one to 1000 gallons per minute . . . pressures up to 1000 lbs. per square inch . . . speeds up to 1800 r.p.m. . . . 21 drives and mountings . . . 8 piping arrangements.

ANY LIQUID

Any liquid free from abrasives can be pumped. It makes no difference how thick or how thin the liquid is, a Roper will handle it economically and efficiently.

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It contains a summary and a digest of solid information concerning pumps and pumping problems.

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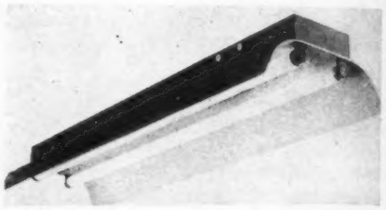
ROPER
Rotary HYDRAULICALLY BALANCED PUMPS

with a suitable governor and fast-closing machine contactor or breaker. One synchronizer and control switch is used for opening the machine contactor coil circuit when it is held closed magnetically. If the contactor is held closed by a latch and tripped electrically, the switch is used in the trip coil circuit. Available for 50-60 cycle service. Westinghouse Elec. & Mfg. Co., E. Pittsburgh.

Fluorescent Fixtures

Non-metallic reflectors, introduced primarily to conserve steel, possess several advantages, the manufacturers claim. They are 40 to 50 percent lighter—making them



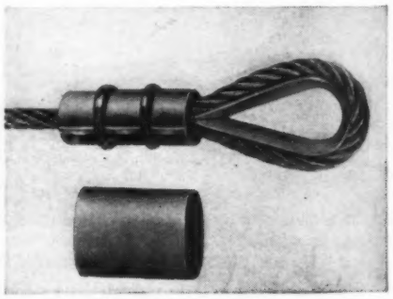
easier to handle during installation; the hard-baked synthetic finishes provide unusual reflection factors; and the non-conductive nature of the composition creates an improved safety factor. The Martin-Gibson Light & Tile Corp., 999 Harper Ave., Detroit.

Correction

The following item, originally published in May with the address of the National Telephone Supply Company incorrectly given, is here repeated with the correct address—5100 Superior Ave., Cleveland.

Oval Splicing Sleeves

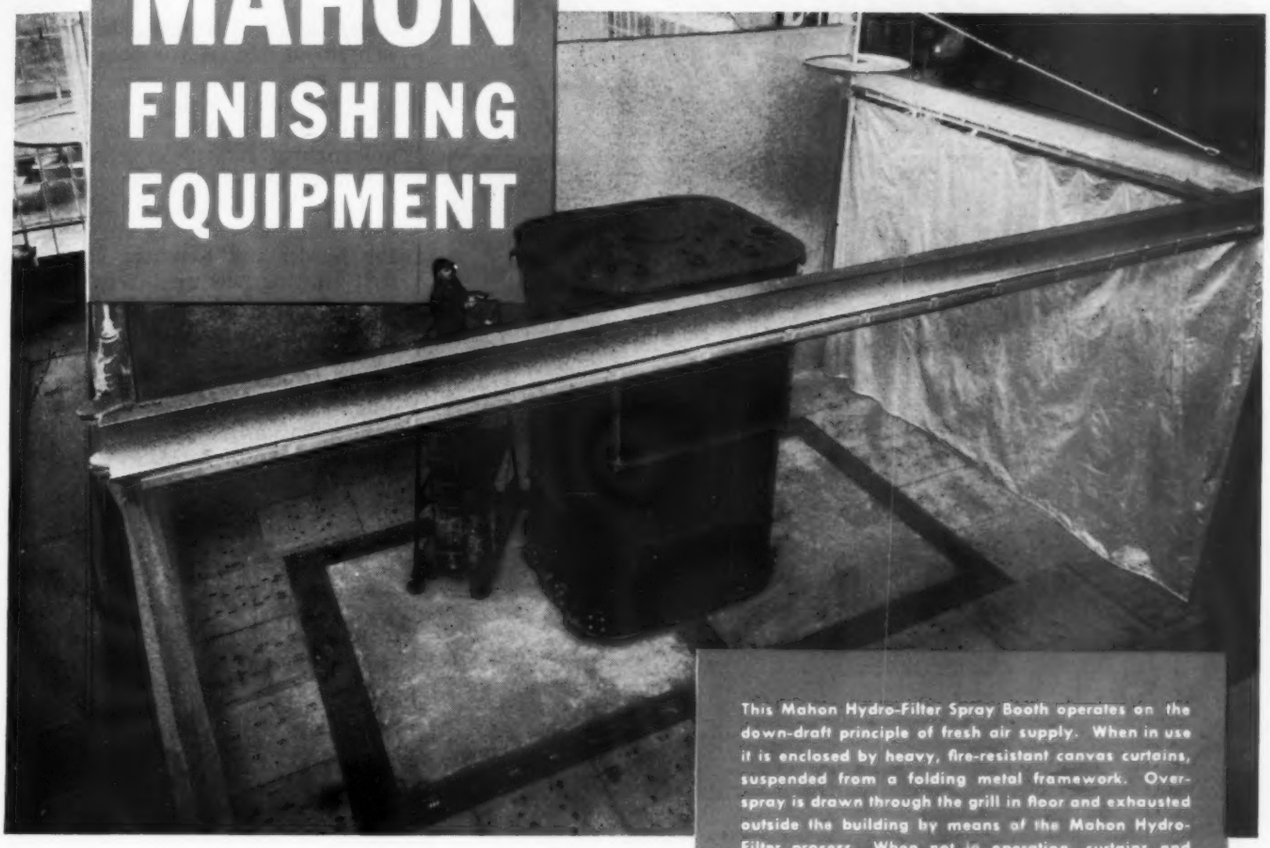
Now being manufactured are oval sleeves for splicing smaller sizes of aircraft-type wire rope up to $\frac{5}{16}$-in. diameter. Known as Nicropress, oval sleeves are made by the same process as that used in making the sleeves used by telephone and electric light



and power companies. By this process a hard metal alloy is sprayed into the inside of the sleeves, which exerts a strong gripping power on the wire rope when the sleeve is compressed onto it. Sleeve is slipped over the ends of the rope and compressed onto them with a light, compact, hand-operated tool. The completed splice is so tight that the rope cannot pull out of the sleeve, and the strength of the splice exceeds the rated breaking strength of the wire rope. Available for splicing aircraft cord of $\frac{1}{16}$-, $\frac{3}{32}$-, $\frac{1}{8}$-, $\frac{5}{32}$-, and $\frac{3}{16}$-in. diameter. National Telephone Supply Co., 5100 Superior Ave., Cleveland.

Built-to-the-Job

MAHON FINISHING EQUIPMENT



This Mahon Hydro-Filter Spray Booth operates on the down-draft principle of fresh air supply. When in use it is enclosed by heavy, fire-resistant canvas curtains, suspended from a folding metal framework. Overspray is drawn through the grill in floor and exhausted outside the building by means of the Mahon Hydro-Filter process. When not in operation, curtains and framework are folded back and space is available for other purposes.

A Typical Example of How MAHON Finishing EQUIPMENT is engineered FOR UNUSUAL PLANT CONDITIONS

This company had a perplexing problem. They urgently needed a spray booth capable of handling an exceptionally large product. But, already overcrowded with war work, no space could be spared for its erection.

Mahon engineers were called in and surveyed the situation. They selected a location convenient to the Drying Ovens (also Mahon installed) and designed and installed a Mahon Hydro-Filter, Down-Draft Spray Booth that efficiently functions whenever painting of the product is required — but that can be folded back out of the way when the space is needed for other purposes. Just another instance of Mahon co-operation — a typical example of how Mahon equipment can be designed and adapted to meet plant, product and operating conditions.

Whatever YOUR requirement may be—spray booth, oven, metal cleaning equipment—or a complete finishing system—Mahon engineers are ready to give you the benefit of their broad experience in advanced finishing methods—and to supply equipment that will put your finishing operations on a faster, better and more economical basis.

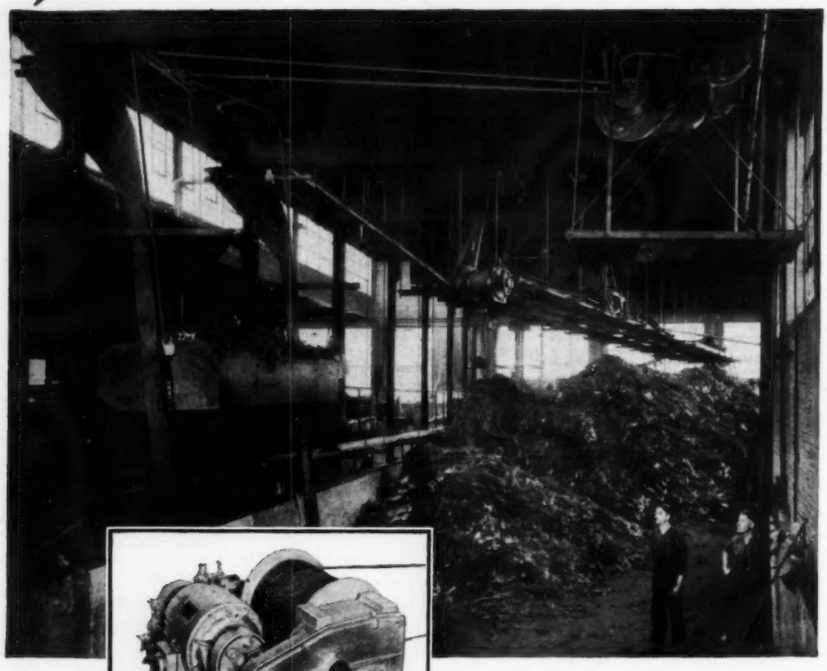
Manufacturers of

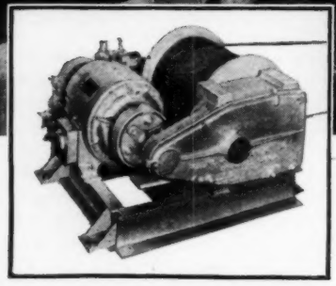
Metal Cleaning Machines, Rust Proofing Machines, Hydro-Filter Spray Booths, Ovens of All Types, Filtered Air Supply Units, Hydro-Foam Dust Collectors—and Many Other Units of Special Production Equipment—including Complete Finishing Systems

THE R. C. MAHON COMPANY • DETROIT • CHICAGO

MAHON

5 ★★★ R&M HOISTS Speed this Firm's War Work!





This view of a winch-type R & M Hoist shows the extremely compact design that provides utmost plant headroom. Hoisting mechanism is so accessible that it may be quickly withdrawn when cover is removed.

You're looking at the scrap department of the United Screw and Bolt Corporation, where a 6000-lb. winch-type R & M Hoist helps salvage vital scrap metal. It not only *speeds* the return of scrap to the mills for reprocessing, but makes this essential job *easier* for the men in the plant.

Four other R & M Hoists are performing equally important lifting and conveying roles in other parts of the plant. Vice President C. E. Kramer says, "We have found that R & M Hoists are the most dependable, and are engineered for long life with minimum maintenance."

And here are still *more* reasons why production men specify R & M Hoists! They're *all steel* from track to hook; they handle loads from *any* angle, with perfect balance; they're *precision-built* for peak performance; their range of capacities, from 1000 to 15,000 lbs., assures the right hoist for every job.

Whatever *your* hoisting problem, "take it up" with R & M! Our expert representatives will help you find the solution. Call the nearest R & M sales and service office, or write us at the factory.

R & M HOIST & CRANE SALES AND SERVICE OFFICES

Albany.....364 Broadway
Atlanta.....319 Walton Bldg.
Baltimore, Lombard & Concord St.
Boston.....55 Long Wharf
Buffalo.....2005 Delaware Ave.
Chicago....2400 W. Madison St.
Cincinnati.....418 New St.
Cleveland..352 Rockefeller Bldg.
Dallas.....1100 Cadiz St.
Denver.....1420 16th St.
Detroit.....2921 E. Grand Blvd.
Houston..3715 Harrisburg Blvd.
Jacksonville....305 Bisbee Bldg.
Newark.....700 Bergen St.
New York.....200 Varick St.
Philadelphia.....401 N. Broad St.
Pittsburgh.....H. W. Oliver Bldg.
San Francisco, 116 New Mtgmry. St.
Seattle.....216 Walker Bldg.
Syracuse....204 State Tower Bldg.
Montreal....Lyman Tube & Supply Co., Ltd.

ROBBINS & MYERS • Inc.

HOIST & CRANE DIVISION • SPRINGFIELD, OHIO

MOTORS • FANS • MOYNO PUMPS • FOUNDED 1878

Moved Without a Shutdown

(*Continued from page 90*)

everything was in full swing, there were about 300 men working on the actual set-up and installation of equipment, excluding building contractors. These men consisted of iron workers, millwrights, carpenters, electricians, plumbers, and steamfitters.

Three large trucks traveled back and forth between the Airport and the Fowler and Kenmore Plants all day, bringing new machinery and old equipment which was being transferred to the new plant. Several crews of iron workers were stationed at the truck receiving dock all the time to unload these trucks and the many others that arrived in a steady stream all day long. Few trucks were ever held up except for the times they got stuck in the ankle-deep mud before the concrete roadway was put in.

Two or three crews of iron workers were kept busy unloading railroad cars, which also came in rapid succession. Both the railroad dock and truck dock were designed so that the floors of the cars and trucks were flush with the floor level of the plant. This facilitated unloading.

It must be remembered that machine tools are heavy. A load was considered light if it weighed 2 or 3 tons. Many of the machines weighed between 10 and 45 tons, and the largest hydraulic press totaled 180 tons. All machinery was transported through the plant on wooden rollers, so as not to injure the surface of the concrete floors. The heavier equipment was hauled by winch trucks, two of which were on the floor at all times.

When a machine came in the door it was unloaded by a crew of iron workers. If it came from the Fowler or Kenmore Plants, it was already tagged. If it was just being delivered, the purchase order had to be checked, and from the form sheets the properly numbered tag was found. The machine was then tagged, and another crew of iron workers took it to the proper location, and removed the skids and crating.

The millwrights followed right after them and lagged the machine to the floor, removed the protective grease, assembled the extra parts, leveled the machine accurately within 0.004 inch (in the machine shop and tool room, within 0.001 inch, by a super-sensitive level), and left it ready to operate.

Next came electricians, plumbers, and steamfitters who supplied power,

Announcing

THE IMPROVED 1/4 INCH

SKILDRILL

- **RUNS QUIETER**
- **STAYS COOLER**
- **DRILLS HOLES FASTER!**

If you've seen SKILDRILL or heard about the thousands of SKILDRILLS in war plants, you know it's perfect for easy, top-speed, day-long drilling. And now you should know that SKILDRILL has been improved... with new special features that put it even farther ahead of every other 1/4-in. drill in the market!

We improved the gearing... made SKILDRILL run quieter than ever without adding an ounce to its easy-handling 2 3/4 lbs.!

We stepped up the cooling system... made this *cool* drill run COOLER without making it bigger (only 2 9/16 in. wide and 6 5/8 in. long). And we offer SKILDRILL in 4 SPEEDS to give you peak performance on whatever material you use... to speed up every production drilling job in your plant. Ask your distributor to demonstrate new, *improved* SKILDRILL today!

THESE SPECIAL FEATURES

- New Quieter, Smoother Gearing!
- New Improved Cooling System!
- 4 Speeds Available!

For fastest drilling on any material
1800 R.P.M. 2500 R.P.M.
3500 R.P.M. 5000 R.P.M.

$32.50

SKILSAW, INC. 5043 Elston Ave., Chicago

New York • Boston • Buffalo • Philadelphia • Cleveland • Detroit
Indianapolis • St. Louis • Kansas City • Atlanta • New Orleans
Dallas • Los Angeles • Oakland • Seattle • Toronto, Canada

SKILSAW PORTABLE ELECTRIC TOOLS

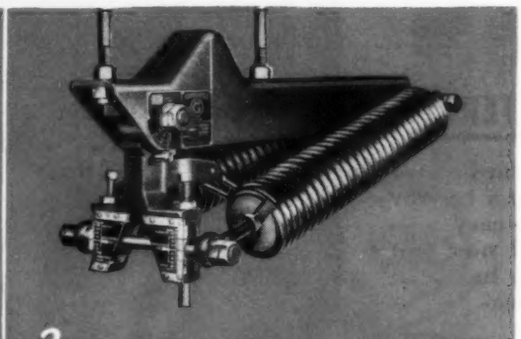
★ MAKE AMERICA'S HANDS MORE PRODUCTIVE ★

4 IMPORTANT TIPS

on Speedier Piping Installation!

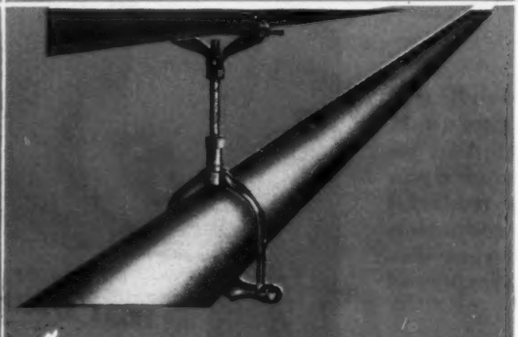
No matter what type of piping system your plant-extension program may call for . . Grinnell's complete range of piping services and products offers short-cuts to a better installation! Here are four time-savers for *you* . . . four of many Grinnell products that are clipping months or minutes off today's war construction schedules involving piping.

PREFABRICATED PIPING by Grinnell saves fabricating and erecting time . . . . supplies speedily-erected, pre-tested sub-assemblies for complete power or process piping systems.



2 GENSPRING CONSTANT-SUPPORT HANGERS for high temperature piping are pre-fitted to exact engineered layouts . . . . . provide floating suspension, speedily installed, for loads from 250 to 8,500 lbs.

GRINNELL WELDING FITTINGS are identically matched with your pipe or tubing . . . tailor-made to cut minutes-per-weld in pipe erection.



4 ADJUSTABLE PIPE HANGERS by Grinnell are engineered to provide the right hanger for ANY piping ANYWHERE. Faster to install . . . more compact.

WRITE FOR Data Folders on these Grinnell time-savers. Grinnell Company, Inc., Executive Offices, Providence, Rhode Island. Branch offices in principal cities.

GRINNELL

WHENEVER **PIPING** IS INVOLVED

air, water, and drains. The schedule called for the machine to be in operation 24 hours after it entered the plant, and was strictly adhered to. Of course, some of the large machinery and equipment required more than 24 hours to erect.

A general foreman was assigned as "move coordinator." He informed the plant layout department which departments were to be set up first, and when certain departments could be moved. It was his job to see that the departments to be moved were prepared to move at the designated time, and that everything was installed according to priority for use. This required close coordination. A worker would leave his machine at the end of one day and be told to report to the new plant the next. His machine would have to be in its proper position ready for operation when he reported for work the next morning.

In most cases this arrangement went off without a hitch. There were many unavoidable delays, of course, but on a job of this size that was to be expected. Sometimes an item as small as a little switch or heater coil held up a machine for days because of the difficulty in obtaining it. Machines sometimes arrived with the wrong motor for the power supply, or perhaps the motor was correct and the switch wrong. Many times machines were hooked up in the most ingenious temporary manner to keep them running until the proper parts could be obtained from their source.

In the majority of cases a department was moved section by section, and every effort was made to prevent interruptions of production. Schedules were closely followed, because, if they weren't, workers would be standing idle.

Like a Football Squad

Several departments, however, were set up in one mass move. The machine shop and fully half of the toolroom, for example, were moved from the Fowler Plant and put into operation all in three days. This meant working 24 hours a day. The iron workers, millwrights, electricians, and plumbers were split into three shifts, while the plant layout department worked two 12-hour shifts during such periods. The trucks kept rolling all through the night, back and forth between the Fowler and the Airport Plants. Teamwork resembled that of a football squad. Before the motor of an arriving truck had been shut off, the iron workers were hard at work unloading it, and other crews were already taking the first machines to their locations. Many of the machines that arrived during the night were

How to get maximum life out of your MULTIPLE V-BELT DRIVES!...

FREE ASSOCIATION BOOK, JUST PUBLISHED, TELLS YOU WHAT TO DO AND WHAT NOT TO DO

UNDER THE pressure of war production, 16 to 22 hours a day operation is using up the life of V-Belts at an unprecedented rate... two to three times faster than normally. Consequently, the demand for replacements has increased in the same ratio at a time when rubber is urgently needed for other war essentials.

As a user of Multiple V-Belt Drives, it is not merely advisable that you conserve the life of your belts... it's imperative... it's a patriotic MUST! Even a month or two of additional belt life is well worth while when you remember there are millions of V-Belts in service.

Realizing the importance of keeping Multiple V-Belt Drives turning for the war effort, the association has published a book of "dos" and "don'ts" to enable power-users to postpone belt replacements. This book, "23 Ways to Conserve the Life of Your Multiple V-Belt Drives" is FREE to power-users. Get it, study it, and apply its recommendations. You'll not only help conserve rubber, but you'll reduce your maintenance costs.

MULTIPLE V-BELT DRIVE ASS'N

TRADE MARK

The use of this emblem by an association member in connection with Multiple V-Belt Drives is your assurance of mechanical excellence . . . the result of cooperative engineering, research and experience.

MULTIPLE V-BELT DRIVE ASSOCIATION

140 SOUTH DEARBORN ST., CHICAGO

Multiple V-Belt Drive Association
140 S. Dearborn St., Chicago

Please send us a copy of your free book, "23 Ways to Conserve the Life of your Multiple V-Belt Drives."

Name.....

Firm.....

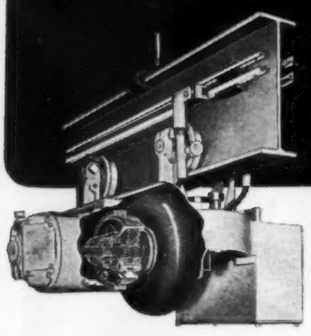
Address.....

AMERICAN MONORAIL EQUIPMENT

TURNS BACK-BREAKING HANDLING

INTO FINGER-TIP HANDLING

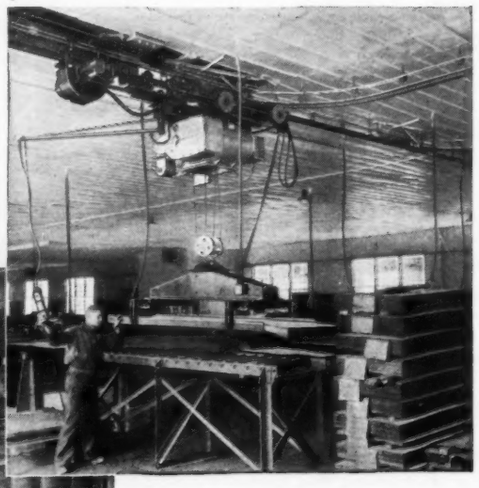
★



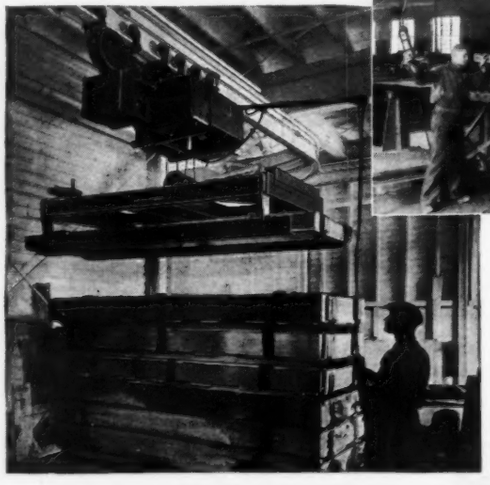
Here are photos of two plants that have recently installed American MonoRail Overhead Handling Equipment. In both of these plants, tons of sheet steel are handled as easily as a small boy handles his electric train—with the same finger-tip control. The handling of heavy loads has become practically child's play. These two installations are typical of hundreds of others that have solved their back-breaking jobs with American MonoRail Equipment.

Today, production is handled with unheard of speed and efficiency. American MonoRail Equipment is playing an important part. An American MonoRail Engineer will gladly explain the advantages of this equipment in your plant. This service is without cost or obligation—furthermore, there is no delay or shutdown during installation. Write today.

Push button switch controls Mono-Tractor, hoist and special grab operations.



Five tons of steel travel overhead by finger-tip control.



WRITE FOR Blue Book illustrating hundreds of MonoRail installations

THE AMERICAN MONORAIL CO.

13114 ATHENS AVENUE ★ CLEVELAND, OHIO

ready to be operated by the first shift in the morning.

In order that no production time might be lost, several departments were moved over the weekends, on the same 24-hour schedule. Moves started Friday afternoon after the first shift, and were completed early Monday morning in time for the first shift. The entire final assembly department, airplanes and all, moved in this manner, and the planes were rolling out the back door on Monday, exactly on schedule, while painters and welders in the steelwork overhead were still doing their job of completing the construction of the plant. One bucket of paint landed upside down in the cockpit of a plane, and several workers had to use turpentine on their hair and clothes.

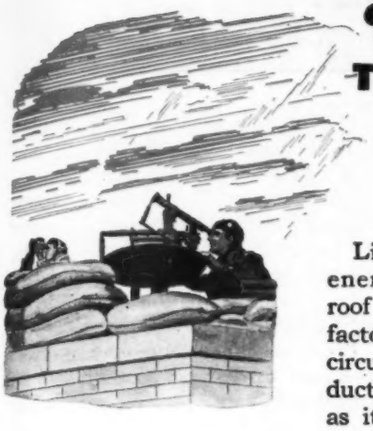
Moves were also scheduled over two holidays. Everyone needed a vacation after the hard grind of the weeks preceding, so even more effort was put into their work, and in each case the work was finished ahead of schedule so they had the two days off.

The move to the Airport Plant started in the latter part of April, 1941. The first department to begin production was the press department which began operations in May. The plant was formally dedicated on August 14 but had been in full production for almost a month previous. The plant layout department continued to iron out the numerous difficulties that arose in the course of getting a new plant into full operation and completing the many details that still hung fire. The work of the outside contractors was gradually taken over by the company's maintenance department until all contractors left the building.

At the Kenmore Plant the move was handled in the same manner. The problem was somewhat more difficult inasmuch as the plant was in operation, and had to be moved around and still kept operating. Almost every department was completely changed, enlarged, and moved to a new location. The work went on smoothly and efficiently. When a machine was moved to its new location, another machine was just a step behind it and ready to be placed as soon as the spot was vacated.

Just as the big job of setting up two plants was drawing to a close, it was decided to produce a new model plane along with the present one. Because of the nature of the plane, the two plants required a considerable amount of rearrangement. Thus the plant layout department proceeded to tackle another task, armed with the invaluable experience gained from the one just completed.

QUICK TO PROTECT PRODUCTION
SLOW TO INTERRUPT PRODUCTION



THE NEW QUICKLAG
NOFUZE "De-ion" BREAKER

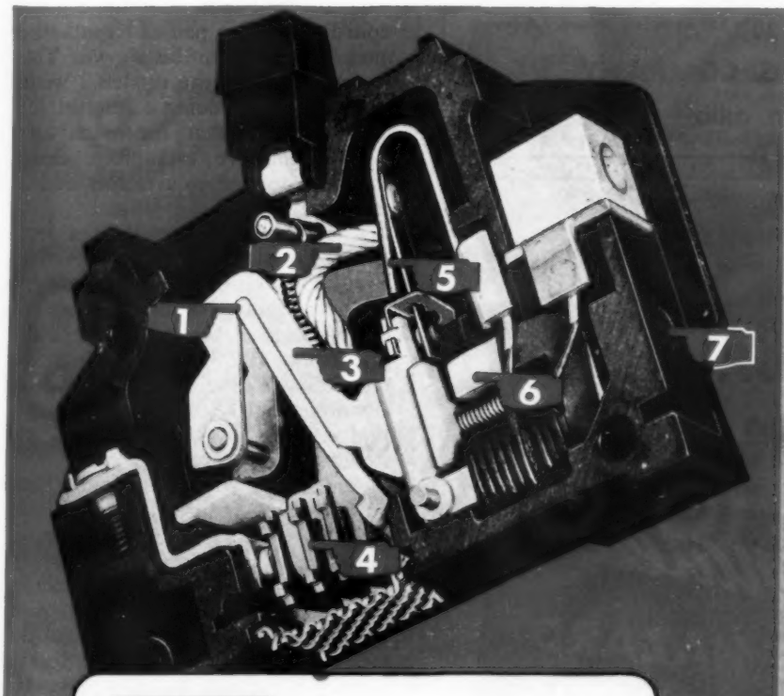
Like the "spotter" of enemy planes on the roof of a war production factory, the QUICKLAG circuit breaker keeps production moving as long as it is safely possible.

This new breaker successfully combines in a single unit a co-operative thermal-magnetic trip action—something never offered before in a protective device.

By this co-operative action, QUICKLAG meets all three requirements of modern lighting, appliance and fractional horsepower loads:

- **PREVENTS UNNECESSARY CURRENT INTERRUPTIONS** on harmless overloads.
- **PROVIDES MORE ACCURATE BURN-OUT PROTECTION** on sustained overloads.
- **INTERRUPTS SHORT CIRCUIT CURRENTS** as great as 5,000 amperes within 1/240th of a second.

Write today for your copy of "QUICKLAG" Bulletin 3146. It demonstrates with graphs how this new breaker gives practical protection for small wire sizes. Or ask your Westinghouse representative for a copy. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N. J-60517



WHY QUICKLAG IS MORE DEPENDABLE, STAYS ON THE JOB LONGER

1. **BEARING SURFACES ARE OF DISSIMILAR METALS** to insure against sticking and to reduce wear.
2. **HEAVY-DUTY FLEXIBLE SHUNT** is electrically welded, keeps wattage losses down.
3. **QUICK-MAKE, QUICK-BREAK** mechanism prevents "teasing" contacts.
4. **"DE-ION" ARC CHAMBER** minimizes arcing, increases contact life.

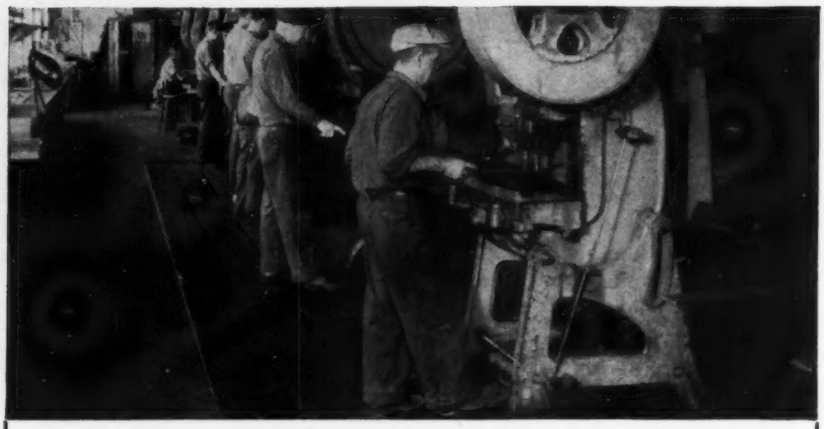
HOW QUICKLAG GIVES GREATER PROTECTION WITH *FEWER* INTERRUPTIONS

5. **BI-METAL THERMAL ELEMENT** provides accurately calibrated flexing action when heated, plus proper tension for spring action to restrain magnetic element on short-time overloads.
6. **ELECTROMAGNET ELEMENT** operates instantly on short circuits.
7. **ACCURATE CALIBRATION**—Calibrating screw provides accurate and uniform calibration during manufacture; is then sealed to prevent "tampering" after test.

SPECIFY QUICKLAG PANELBOARDS

Westinghouse builds QUICKLAG breakers in panelboards of the single-row type shown at left, suitable for H-beam mounting, and the double-row type for wall mounting. Other Westinghouse panelboards are available having combinations of QUICKLAG and 2 or 3-pole common-trip Nofuze "De-ion" breakers.

Westinghouse
NOFUZE
CIRCUIT PROTECTION



PINCH HITTING FOR RUBBER!

Carey CORRUGATED FLOOR RUNNER

LESSENS ACCIDENTS . . PROTECTS FLOORS . .
COMFORTABLE UNDER FOOT . . LOW COST . .

This product of Carey research is of asphaltic composition; similar in appearance to rubber floor runner, serves same useful purposes. Used extensively in factories, offices, halls—even before rubber became unavailable. Non-skid, resilient surface promotes safety and efficiency of workers. Durable; very economical. Available in rolls 36" wide, 30' long; also in Floor Mats, Stair Treads. Write for samples, prices. Address Dept. 31.

THE PHILIP CAREY MFG. COMPANY
Dependable Products Since 1873
Lockland, CINCINNATI, OHIO
In Canada: The Philip Carey Co., Ltd. *Office and Factory:* Lennoxville, P. Q.

Carey GREASE BALL

ASBESTOS SWEEPING COMPOUND

This safe sweeping compound quickly removes oil and grease deposits. No acids or caustics; will not erode. Recommended for garages, filling stations, factories, wherever oil and grease spillage occur. Very economical; can be re-used. Available in 50-lb. bags. Write for sample and prices. Address Dept. 31.

THE PHILIP CAREY MFG. CO.
Dependable Products Since 1873
Lockland, CINCINNATI, OHIO
In Canada: The Philip Carey Co., Ltd.
Office and Factory: Lennoxville, P. Q.

What Camouflage Can Do

(*Continued from page 95*)

plants in a variety of local scenery scattered from Seattle to Boston, and from Pensacola to San Diego.

Among the most important weapons of concealment architecture are color and texture. Special paints, plus nets, artificial and natural foliage, earth, and a vivid imagination, combine to make effective camouflage.

Today when a camoufleur is commissioned to design a "cam job," he immediately confers with local civilian defense authorities, plant owners, adjacent property owners, and the Army Command. From air photos and sketches he painstakingly builds a scale model of the area, working out his problems thereon. These are sufficiently accurate that their public display would be against the nation's best interests.

However, I was recently commissioned to build a pair of hypothetical models which can be shown. They are precisely like the models I would build if I were doing an actual job. They show the scene before and after a comprehensive camouflage design has been applied to a factory and its environs.

The center of interest is a large American plant embodying various kinds of buildings found in industry.

This imaginary factory is on a river. On one side of the factory are main-line tracks and tree-dotted hills; on the other, an industrial town. There are pronounced landmarks such as a bridge, dock, slips, parking lots, and storage tanks.

Across the river is a small town with nearby farms, and a curving highway normally used to transport farm produce and tourists.

To camouflage only the factory would not have been intelligent practice. If the enemy expects to find the target in a certain location and none is visible, he will be suspicious. He will study photographs more carefully and quickly find the exact location of the hidden plant.

To hide or obscure adjacent reference points even several miles away is as necessary as hiding or obscuring the target itself. If the enemy is to be kept from rapidly penetrating our mask, we must resort to area camouflage. In this model, it will be seen that we have taken full advantage of common physical characteristics of the river above and below the actual target.

In a real problem, such total camou-

WARTIME LIGHTING COSTS REDUCED!

General Electric announces a 12% to 17% reduction in the price of G-E MAZDA FLUORESCENT LAMPS!

Effective September 1, 1942
NEW LOW PRICES ON G-E MAZDA F LAMPS
14-WATT T-12 . . . was 80c . . . now 70c
15-WATT T-8 . . . was 65c . . . now 57c
15-WATT T-12 . . . was 80c . . . now 70c
20-WATT T-12 . . . was 80c . . . now 70c
30 WATT T-8 . . . was 80c . . . now 70c
40-WATT T-12 . . . was $1.15 . . . now 95c
100-WATT T-17 . . . was $2.60 . . . now $2.15
Above prices refer to daylight and 3500° white. Prices also reduced on soft white and colored G-E MAZDA F lamps.
Also reduced! G-E MAZDA H (Mercury) LAMPS
400-WATT T-16 AH1 . was $11.00 . now $9.50
400-WATT T-16 BH1 . was $11.00 . now $9.50
3000-WATT T-9½ AH9 . was $45.00 . now $40.00

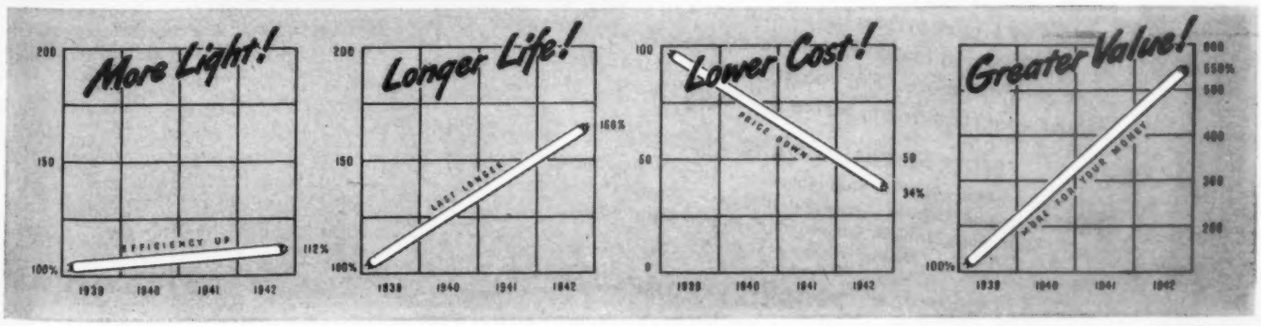
THE SEVENTH REDUCTION IN FOUR YEARS!

NO price reduction, of the many we have been able to make, gave us in General Electric as much genuine satisfaction as this one—made possible at a time when light is being called upon to play a major role in wartime production.

Made in the face of rising cost trends, this reduction is the result of manufacturing economies and technical developments, combined with vastly increased use. It is made in accordance with G-E's policy of passing such savings along to customers.

But lower prices are only half the story. Not only have we been able to reduce prices, we have steadily improved these lamps. They give more light! They last longer! They *stay brighter longer!*

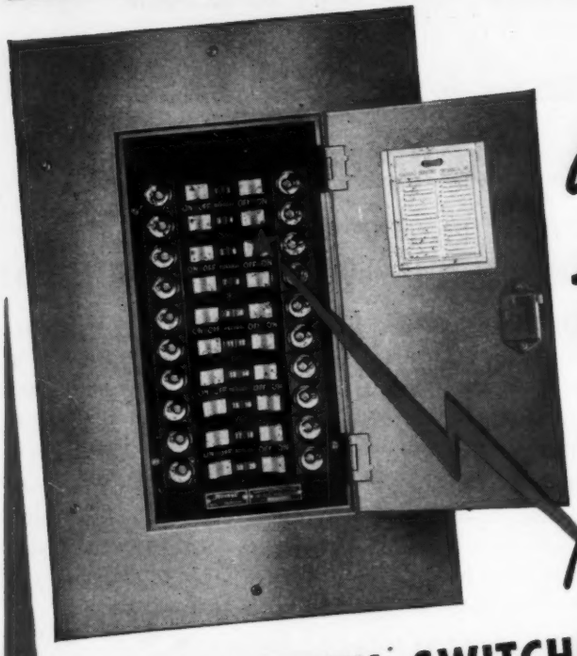
For instance, purchasers of the widely used 40-watt white G-E MAZDA F lamp now pay only 95c instead of the $2.80 they paid in 1939. But we are prouder that this lamp lasts 66% longer and is nearly 12% brighter . . . that it gives you 5½ times more value for your lamp dollar than it did in 1939! (See charts below.)



G-E MAZDA LAMPS

GENERAL ELECTRIC

FEDERAL
ELECTRIC PRODUCTS



at this point

THE "SAFETY SWITCHMAN" CARRIES THE LOAD

In Federal Panelboards, the "Safety Switchman" is an ingenious switch that stands constant watch ahead of every fuse. This means a higher safety factor and perfect control protection of lighting and small power circuits. Federal Type NTPR Panelboards—to handle from 4 to 40 circuits—are compact, ruggedly built, and approved by Underwriters Laboratories. They have quality construction features that you'd expect would cost considerably more. *For complete Federal panelboard specifications, write for Bulletin No. 21-40.*

FEDERAL PANELBOARD FEATURES

Shallow Boxes for Thin Wall Mounting • Large Wiring Gutters
Flush Locks and Catches, Concealed Hinges • Plenty of Knockouts
Solderless Terminal Connectors • Rugged Construction
Giant Switches • Low Cost

FEDERAL ELECTRIC PRODUCTS COMPANY, INC.
58 PARIS STREET, NEWARK, N. J.

Follow the Federal Line

PANELBOARDS • SWITCHBOARDS • SAFETY SWITCHES • CIRCUIT BREAKERS

flage can only be accomplished with the understanding and cooperation of everyone in the target area. At least 35 percent of the effectiveness of camouflage depends upon what is known as "camouflage discipline," or the willingness of everyone in the area under observation to abide by a set of rules. These may include such widely varied requests as prohibition of smoking chimneys; abandonment of certain roads; constant maintenance of shine-reducing or glare-reducing properties on railroad tracks and high tension wires; organization and distribution of traffic at certain hours; parking of cars according to a preconceived plan; frosting of certain windows to eliminate sunset and sunrise glare.

In this model, a large portion of the factory was "broken" by painted surfaces having the appearance of smaller buildings from bombing altitudes. The shape and height of smoke stacks were minimized by irregular shaped wood and cable fins attached about halfway up the stacks and painted to blend into the surrounding design.

Handling Shadows

In dealing with the shadow problem, paint alone is not enough. Paint needs an ally—a three-dimensional, sun-reflecting, shadow-casting ally. Light must be introduced into shadow areas, and incidental shadow areas introduced into light areas.

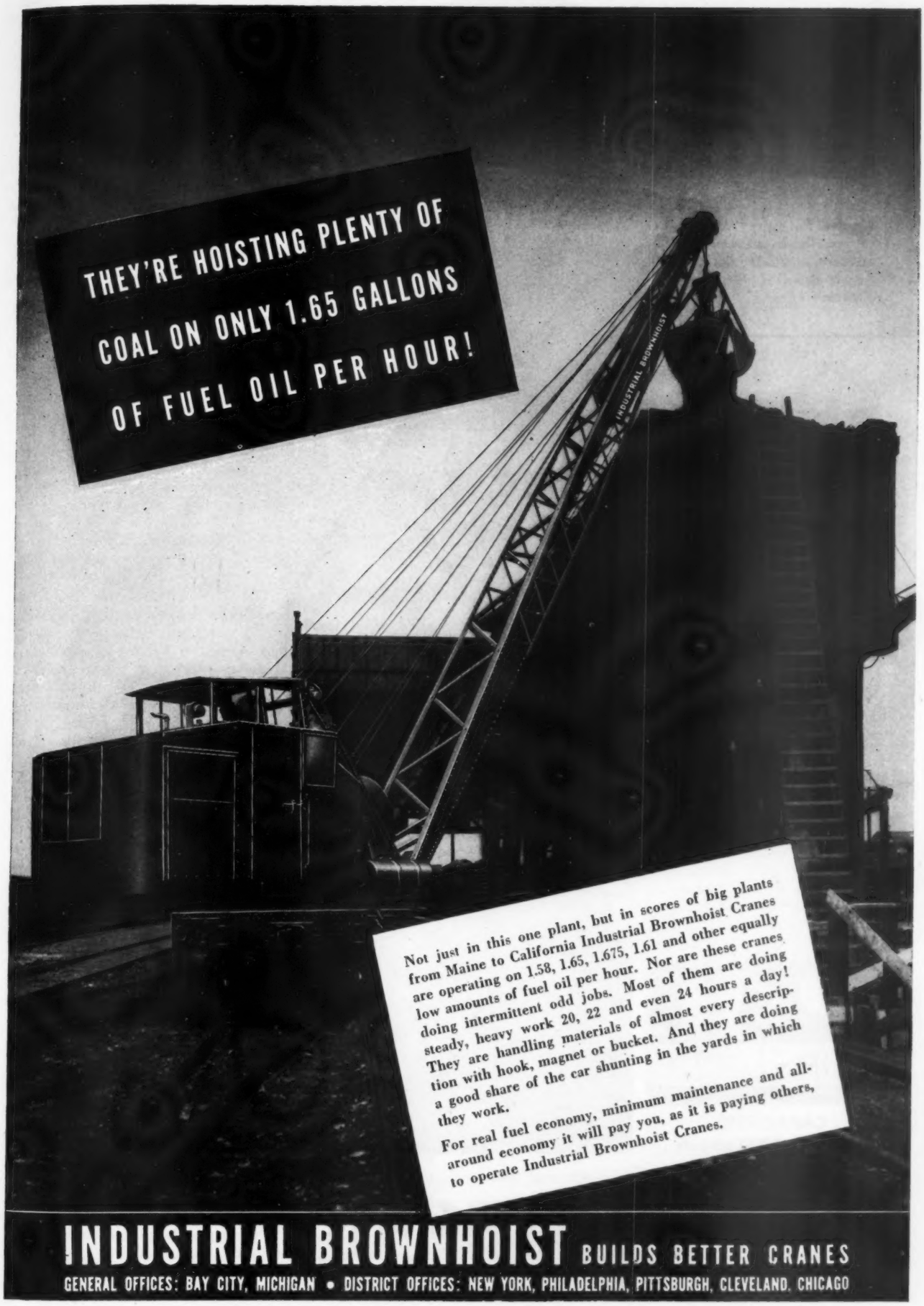
Long, straight, persistent shadows cast by rows of buildings must be broken up by these structures. Construction must be such that only the effect is visible from the air. Methods of supporting and maintaining these shapes, nets, or canopies must not be seen.

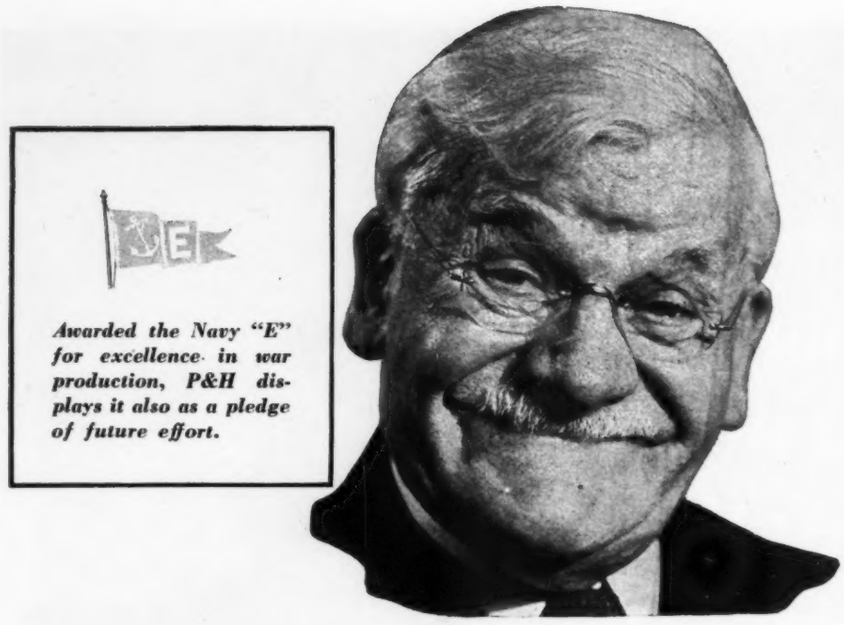
Construction must be cheap, fireproof, waterproof, and windproof. It must be light in weight and have a certain amount of elasticity. Hard-boiled construction looks static and stiff from the air. Circus-tent construction, moving a little in the breeze, is more desirable.

This construction must also be designed with a view toward maintenance. If the war continues longer than optimists say, it may be necessary to renew our paint from time to time. And, of course, the changing seasons present a maintenance problem.

The appearance of forested areas in the camouflaged model is accomplished through nets and flexible wire mesh on which are laced and draped colored tattered cloth and kindred material, known as "garnish," and the whole painted according to a pattern.

To make a flat surface take on protuberances and depressions, it helps to take advantage of the high- and low-visibility property of certain pigments. It is not done by contrasting values


THEY'RE HOISTING PLENTY OF
COAL ON ONLY 1.65 GALLONS
OF FUEL OIL PER HOUR!
INDUSTRIAL BROWNHOIST
Not just in this one plant, but in scores of big plants from Maine to California Industrial Brownhoist Cranes are operating on 1.58, 1.65, 1.675, 1.61 and other equally low amounts of fuel oil per hour. Nor are these cranes doing intermittent odd jobs. Most of them are doing steady, heavy work 20, 22 and even 24 hours a day! They are handling materials of almost every description with hook, magnet or bucket. And they are doing a good share of the car shunting in the yards in which they work.
For real fuel economy, minimum maintenance and all-around economy it will pay you, as it is paying others, to operate Industrial Brownhoist Cranes.
INDUSTRIAL BROWNHOIST BUILDS BETTER CRANES
GENERAL OFFICES: BAY CITY, MICHIGAN • DISTRICT OFFICES: NEW YORK, PHILADELPHIA, PITTSBURGH, CLEVELAND, CHICAGO



Awarded the Navy "E" for excellence in war production, P&H displays it also as a pledge of future effort.

"Johnny-on-the-spot" I CALLS IT!

"Honest delivery dates mean everything in these days of hurried war production. That's why we cheered when our last Zip-Lift arrived on the date promised. In no time at all we had it plugged in — handling loads 'thru the air' — replacing back power with push buttons — giving production a lift."

And it's "Johnny-on-the-spot" around machine tools, along assembly lines, in foundries, on loading platforms, etc., wherever loads must be handled frequently. Available for bolt, hook or trolley mounting. Ready for use on any standard lighting circuit. It's the quality hoist in the low-price field.

P&H ZIP-LIFT
HARNISCHFEGER CORP. MILWAUKEE, WIS.

CAPACITIES
250, 500, 1000 pounds

General Offices: 4525 West National Avenue, Milwaukee, Wisconsin

HARNISCHFEGER CORPORATION
HOISTS • WELDING ELECTRODES • MOTORS P&H EXCAVATORS • ELECTRIC CRANES • ARC WELDERS

alone, but by the use of colors and shades of widely separated specular visibility. Brilliant primary colors of high visibility used next to background colors of olive drab and grays will seem to pop out. Often bad combinations of colors result in optical vibration and an erroneous conception of depth and dimension. Careful study of this phenomenon enables the camoufleur to simulate structures in relief on a perfectly smooth surface without resorting to tricks of perspective which are effective under some conditions and from certain viewpoints but are completely in error from others.

There are all degrees of camouflage besides the costly total camouflage which these models demonstrate. There are numerous places where the train and highway sheds included here and necessary to continue the forest design would not be practical. Primary camouflage with paint alone is frequently considered enough to confuse the approaching bomber until an anti-aircraft barrage can come into play. Today we have camouflage paints that react to all known photographic and sensitometer tests precisely as does natural foliage. This one advancement in technology has been an immeasurable aid to camoufleurs.

These new infra-red reflecting properties have also increased the durability of paint and reduced the inside temperature of the object painted as much as 15 degrees when compared with the same color in ordinary paint.

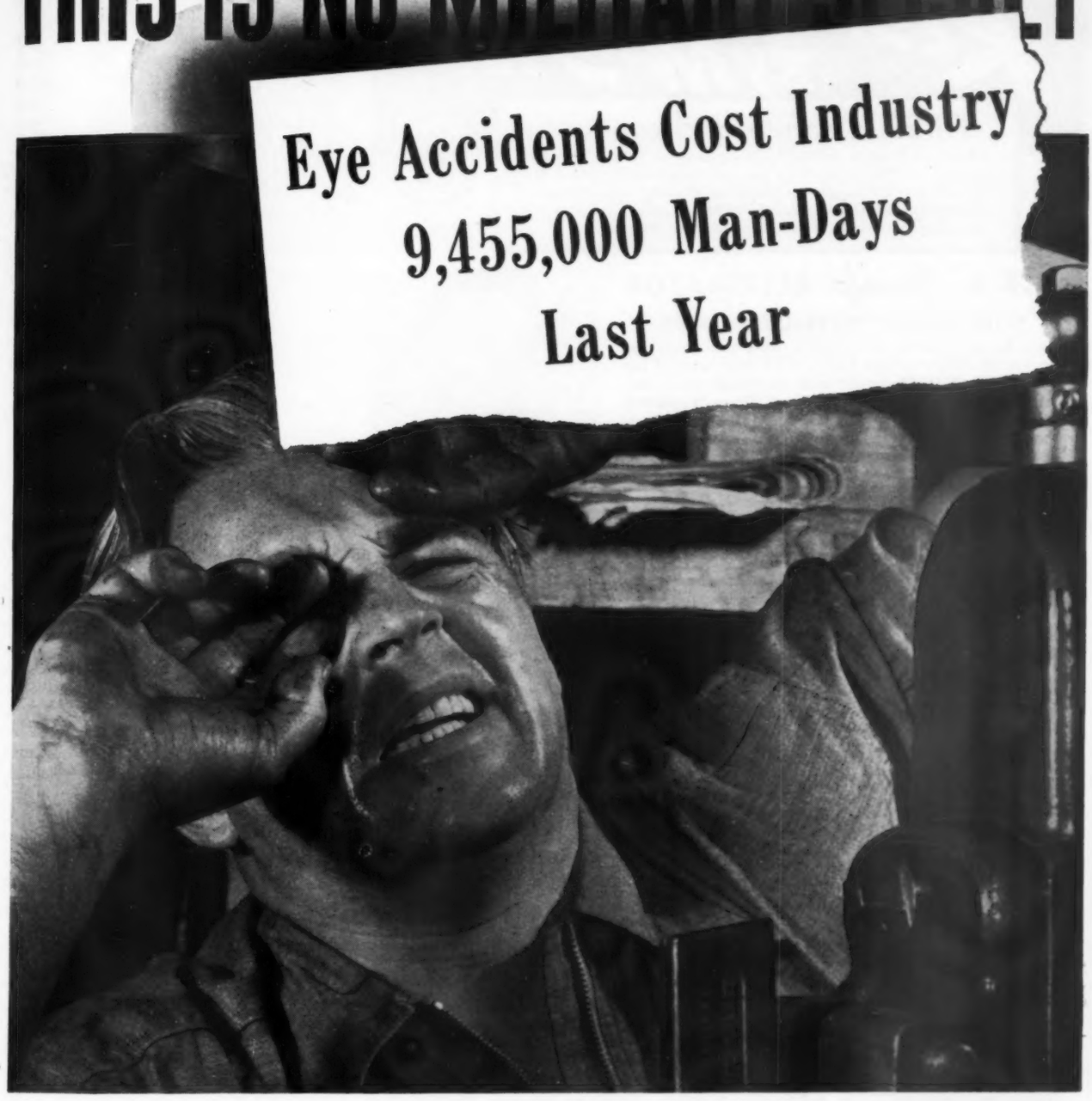
The architecture of concealment is worthless if it interferes with the normal production capacity of the plant to which it is applied. This means more than merely avoiding fastening nets and fabrics where they will be tripped over. It means retaining as pleasant working conditions as possible by specifying a heat-resisting camouflage paint to replace the gleaming aluminum paint widely used to deflect heat. More than a mere notion, this point has been proved decisively in the first few "cam jobs" done in America.

Women—They're Here to Stay

(*Continued from page 99*)

press. Over there a line of girls are operating punch presses. In this department several dozen girls are filing, burring, or assembling small fittings for fuselages. Next door are women welding a variety of small assemblies and fittings. All of the women welders come to us from one of the schools

THIS IS NO MILITARY SECRET



The tremendous number of eye accidents that are slowing up our vital war production are also robbing America of the invaluable services of much skilled labor

American Optical Company offers the means of minimizing eye injuries—a complete line of protective, comfortable goggles, for every type of industrial eye hazard. More than this, AO trained Safety Engineers will gladly work with *your* Safety Director in every possible way toward installing and maintaining the most effective and economical eye protection program for your plant.

Get in touch with your nearest American Optical Company Branch Office as soon as possible.

American Optical

COMPANY

SOUTHBRIDGE, MASSACHUSETTS

FOR YOUR DUST AND FUME HAZARDS . . .

RESPIRATORS BY M·S·A

FIRST in safety and comfort

These respirators provide the utmost in value for each specific application. They are manufactured exclusively by the world's largest commercial producer of approved safety equipment—headquarters for all industry for every safety requirement. Demonstrations on request.

M.S.A. *Comfo* RESPIRATOR

WITH PLASTIC FILTER CONTAINERS

This husky veteran in complete dust protection has proved its ability to take hard service over years of top popularity. Now designed with all-plastic filter containers, the Comfo, U. S. Bureau of Mines Approved, offers even lower breathing resistance—better sidewise and downward vision—high impact strength—non-conductor of electricity. Flexible, easy-fitting facepiece, twin replaceable filters, other superior features are detailed in Bulletin CR-9.

M.S.A. *Dustfoe* RESPIRATOR

Best-selling wherever compact size, light weight and safety are demanded, the Dustfoe, U. S. Bureau of Mines Approved, is easy to wear and simple to maintain. Deep facepiece is contoured for snug fit, with soft facecushion for maximum comfort; foolproof exhalation valve, protective filter cover, strong and simple construction throughout provide troublefree service on the job. Write for Bulletin CM-5.

M.S.A. CHEMICAL CARTRIDGE RESPIRATOR

For paint spraying and other industrial processes where harmful or irritating gases and vapors are encountered in light concentrations. Comfo-type facepiece is equipped with twin chemical cartridges, providing three times the service life of single cartridge types. The cartridges are quickly replaceable—the respirator body, like all M.S.A. respirators, is easy to clean and may be sterilized without harm. Bulletin EM-3.

M.S.A. *Comfo* METAL FUME RESPIRATOR

Thoroughly protects the wearer from toxic fumes of burning or molten metals such as lead, cadmium, zinc, manganese, chromium, arsenic, etc., as encountered in burning, pouring or molding operations. Of basic Comfo design, the respirator, U. S. Bureau of Mines Approved, employs specially-processed replaceable filters with low resistance to breathing. Bulletin CR-6. (See Bulletin CR-8 for special Welder's Model).

M.S.A. AIR LINE RESPIRATOR

Wherever the worker is exposed to a variety or mixture of dusts, gases and fumes, this respirator renders him completely independent of the working atmosphere. Compressed air is supplied to Navy-type half-mask facepiece through flexible corrugated tube from control valve at belt—double exhalation-valves increase breathing comfort. U. S. Bureau of Mines Approved. Bulletin CS-9.

MINE SAFETY APPLIANCES CO.

Braddock, Thomas and Meade Streets, Pittsburgh, Pa.

District Representatives in Principal Cities

where they have specialized in this particular field. They are first put on practice work and on tacking jobs until they can pass the Navy test and qualify for regular production work.

Riveting is another job the girls are beginning to regard as their own. Sometimes two girls work together. One shoots; the other bucks. Then they switch around. Or just as often a man and a women work as a riveting team, seemingly unaware that they are anything but two workers whose sole job it is to help turn out more torpedo bombers and beat the Axis.

Naturally we were quite unprepared for the sudden influx of women. Plant No. 2, where the women are employed, is not much more than a year old. It is air conditioned so that women who are new to factory work may at least spend ten hours a day in the most comfortable of surroundings. On the other hand, we have had to do a certain amount of improvising. We do not, for instance, have the space for locker rooms and the kind of restrooms we should like to provide. Fortunately, however, the men's toilets and washrooms are on mezzanines, so it was possible to build similar facilities for women directly under them.

Enough Cafeteria Space

Fortunately, too, our cafeteria is big enough to carry the increased load. At one end we serve complete meals, hot or cold; at the other the girl who is watching her figure may buy a sandwich, a bottle of milk, cup of coffee, etc. That is to say, women may eat any kind of lunch they like. A great many of them bring their own lunches and buy only something to drink. In any case they make free use of the cafeteria. Eating at the workplace is, for that matter, prohibited.

Our girls are uniformed. The first group who came were allowed to help choose a uniform and to select the color. They chose a light blue. It was lovely but did not work out too well. Showed the dirt too quickly. The blue was changed forthwith to a darker hue, just as nice and much more practical. But it meant having 2000 uniforms in stock or on order dyed the new shade. Two uniforms are issued to each girl who is thereafter responsible for laundering and upkeep.

On the whole we have found women easier to supervise than men. They are possibly a little overawed at first. A factory is a mighty mysterious place to most of them. They are eager to learn, so are more than ready to do what they are told to do. They do less kicking, we find, than the men. Perhaps this favorable situation will change as they become old hands, but we are more inclined to attribute the present absence of grievances to

FIRE and how to fight it!

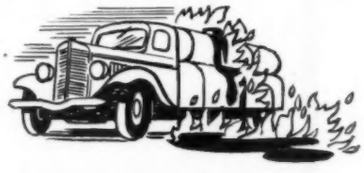
HOW DO YOU KILL FLAMMABLE LIQUID BLAZES?

Q. What are flammable liquid fires?

A. They are fires in oils, gasoline, solvents, paints, lacquers, and the like. Authorities call these Class "B" blazes and recommend extinguishers with a *smothering* or *blanketing* action.

Q. Will every type of extinguisher work on all kinds of flammable liquid fires.

A. No! Water streams, for example, are usually ineffective and extinguishers which employ a liquid stream will not handle three-dimensional blazes.



Q. What is a three-dimensional blaze?

A. It is a fire which burns at more than one level, as when a container ignites and spills a flowing stream of burning liquid over its sides. Carbon dioxide extinguishers readily handle this type of fire. Work from the bottom up. Kill the fire at the lowest level first.

Q. What is a running fire?

A. It is a flammable liquid blaze which occurs when a flowing stream becomes ignited. You fight this fire by working against the flow of the liquid. If a pipe is leaking, start at the extreme edge of the fire and work back toward the pipe. If a container is spilling its burning contents, work toward the container.

Q. What is a spill fire?

A. This is simply a fire resulting from liquid spilled on the ground or on the floor. Don't try to kill all of this fire at once, if it covers a large area. Start at one point, smother all flames there and continue, part by part, until the entire fire is out.

If you are outdoors, *keep wind at your back.*

Q. How about fires in open vessels?

A. Where possible, "bank" extinguisher stream (foam or vaporizing liquid) off inside wall of container. Don't squirt the stream directly on burning surface. Circle the fire. Work around, attacking blaze from various angles.

MAKE EXTINGUISHERS LAST LONGER

Since December, 1941, Walter Kidde & Company has had an unusual war job . . . to make the products that save fighting men's lives.

Kidde products include:

Rescue rafts and vests
Aircraft flotation gear
Power-actuation equipment
Crash trucks
Built-in extinguishing systems for planes, ships, army tanks
Aircraft vapor dilution systems
Oxygen cylinders, valves
Flame detectors
Impact actuators
Shatter-proof high pressure cylinders

Since we have fewer Kidde Extinguishers* to sell, we are trying to make your existing equipment more efficient.

If you want reprints of this series of advertisements, just write Walter Kidde & Company, Inc., 912 West Street, Bloomfield, N. J.

Kidde

* Formerly known as "LUX" extinguishers.

Faster and Smoother

OVER ALL GRINDING OR SPOTTING

OF STEEL AND ALLOY PLATES, STRIP, TUBES, BARS or SHEETS and FOR FAST REMOVAL OF WELD FLASHINGS.

with an

ABRASIVE BELT SWING GRINDER

using

3-M ABRASIVE BELTS

3 TO 6 TIMES FASTER are claims made by users of this method for smooth, even grinding. Here you combine controlled stock removal features of a snagging wheel and smooth, even surface grinding features of disc grinders. The machine can be tilted to follow contours. Swing Grinders using Segment Face Contact Wheels and 3-M Abrasive Belts are free of chatter and are being adopted for speeding up war production in hundreds of plants.

If you are grinding welded tubes, gun mount sections, armor plate, steel and alloy strip, bars or sheets, or are grinding and removing scale or surface imperfections, may we have our sales engineer call and explain in detail how this 3-M Method will help you.

Swing Grinders are manufactured by The Jones Engineering Company
Elwood City, Pennsylvania

SEND FOR THIS BOOKLET THAT GIVES COMPLETE INFORMATION AND TELLS HOW TO SPEED UP PRODUCTION IN GRINDING AND FINISHING DEPARTMENTS.

Name.....

Company.....

Address.....

City..... State.....

FM&M942

MINNESOTA MINING & MFG. COMPANY

SAINT PAUL MINNESOTA

MFRS. OF 3-M PRODUCTS 3-M Abrasive Paper and Cloth Products—"Scotch" Tapes 3-M Elastic Cements—3-M Wax and Sealer—3-M Lapping and Grinding Compound—3-M Cutting and Finishing Compound—3-M Roofing Granules

woman's greater patience and adaptability.

Do women get tired more quickly than men? Obviously most of them cannot "take it" week in and week out as the men do. We compensate for physical handicaps to some extent by giving women the lightest jobs and by being somewhat more lenient about trips to the restroom. They do not abuse this latter privilege, but most of them take all the law allows.

We do have more absenteeism among the women than among the men. At the present time our women are working 56½ hours a week. Personally, I believe the trend toward a 48-hour week for all war workers is a good one. The present work week is a long one, so many of the absences are due to physical causes. On the other hand, just about as many may be attributed to the need to catch up with work at home, as many of the housewives must, or to the desire to go shopping. Our records on this point are still fragmentary, but we are pretty sure the absenteeism curve takes a sharp jump the day after payday.

So far we have had no increase in number of accidents. This may be due partly to the fact that women's jobs at Grumman are almost all of the nonhazardous variety. We have a little difficulty here and there getting women to observe safety rules. One girl on a sander objected to wearing a respirator; said it was uncomfortable. Fact of the matter was, she didn't like the looks of it. Women are naturally conscious of anything that does not enhance their natural charm, and in that respect women in industry are just like women in stores and offices and kitchens.

All in all our experiences add up to this: We like women in our plant. They are doing good work. They have in no wise disrupted our organization. They have caused no serious problems. We may have thought a year ago that we could never get along *with* them. Today we know we can never get along *without* them. In my opinion they are in industry to stay.

"Gold" in the Scrap Pile

(*Continued from page* 101)

light, and cannot be separated by visual inspection. By segregating the scraps into small piles and lighting them with a single 24-in. daylight fluorescent lamp in a concentrating reflector, the tantalum can be identi-

Speed WAR PRODUCTION

with more efficient handling of materials and papers . . .

1.

WIN THE BATTLE OF PRODUCTION,

case histories of 11 different types of industry, 15 illustrations and 4 diagrams showing how these industries *increased production* without adding to personnel.

2.

WASTED STEPS SABOTAGE PRODUCTION,

inadequate materials and message handling equipment can be more costly and wasteful than a Fifth Columnist in your plant.

3.

WATCH PRODUCTION ZOOM,

facts and views from America's leading aircraft plants, showing how Lamson equipment is *increasing production* with same number of workers.

★

MAIL THE COUPON FOR THESE TIMELY BULLETINS WHICH OUTLINE METHODS AND EQUIPMENT YOU CAN USE IN YOUR PLANT

The uses and mass economies of properly designed materials and message handling equipment are almost limitless. These booklets spotlight applications that are particularly important right now in *war production.*

Write for your free copies today. Ask for the bulletins that fit your especial needs.

LAMSON CORPORATION
219 Lamson St., Syracuse, N. Y.

Gentlemen: Kindly send me the materials and message handling bulletins checked below:

1—Win the Battle of Production ☐
2—Wasted Steps Sabotage Production ☐
3—Watch Production Zoom ☐

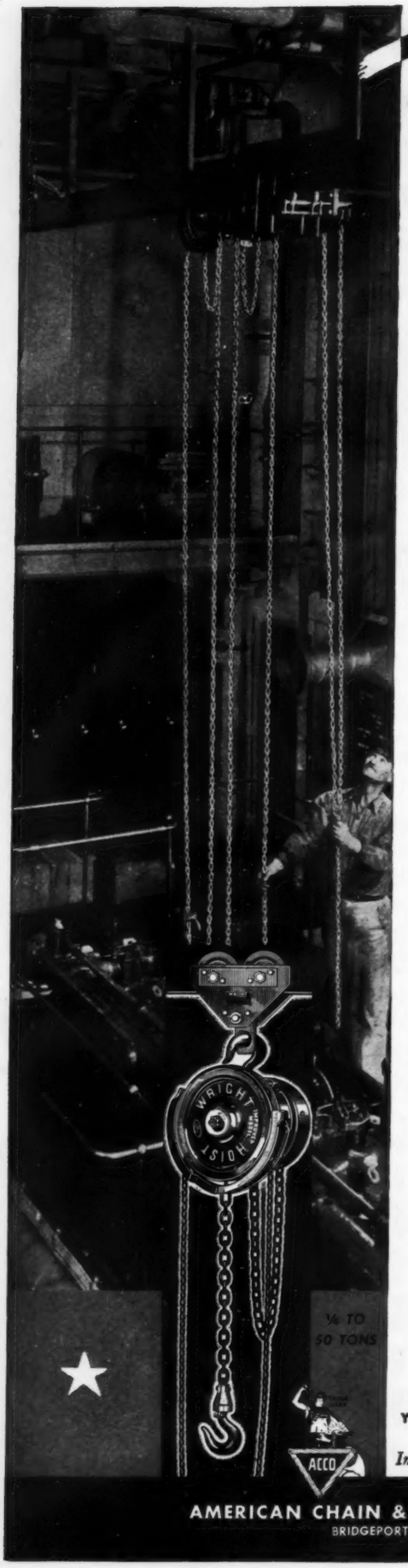
Name.....

Title.....

Company.....

City.....*State*.....

LAMSON
CONVEYORS and DISPATCH TUBES



Don't OVERLOAD YOUR HOIST

• Although **WRIGHT HOIST** are built with load-carrying factors much in excess of their rated capacities, like many other well-made pieces of mechanical equipment built for specific duty, they should not be overloaded. Overloading is dangerous—to men, materials, machinery and steady production. Abuse to machinery, today, is akin to sabotage.

WATCH THE BOTTOM HOOK

• Wright load hooks are drop-forged from special steel which, when subjected to excessive overloading, gives visible warning by opening slowly. When the bottom hook has started to open, look to the top hook, too, for while it is stronger than the bottom hook, it also may be reaching a danger point.

WATCH THE LOAD CHAIN

• **WRIGHT HOIST** load chains are electrically welded from special analysis steel, exceptionally high in tensile strength and elastic limit. Chains that are excessively overloaded will stretch out of pitch, thus preventing proper fit with precision load wheel pockets. This results in destructive wear to both chain and load wheel. Keep your chains well-lubricated for long life.

Victory demands all out efficiency in production. Victory demands speed. Victory demands steel. Abuse of machinery wastes all three. Take proper care of your **WRIGHT HOIST** so that it lasts. You can find the name of your nearest Wright distributor in the telephone book.

WRIGHT MANUFACTURING DIVISION
YORK, PA. CHICAGO SAN FRANCISCO NEW YORK

In Business for Your Safety

AMERICAN CHAIN & CABLE COMPANY, Inc.
BRIDGEPORT - CONNECTICUT

fied instantly by its apparent bluish hue, while molybdenum retains its characteristic metallic color. This method, developed by the Westinghouse Lamp Division at Bloomfield, N. J., is so foolproof that these materials are now sold separately with a purity guarantee. Formerly valuable tantalum pieces were interspersed with the rest of the mass which had to be salvaged, and sold as mixed molybdenum and tantalum scrap.

Scrap Mostly Ferrous

Naturally, the largest percentage of surplus, inactive, and obsolete materials that get to the salvage division is ferrous. It is made up of iron, steel, and their various alloys. After all the routine steps of reclamation have been exhausted, and the materials have been properly separated according to grades, steel and its alloys are sheared or torched to the best usable sizes, and either loaded in gondola cars for shipment or temporarily stored for later use. Handling these materials from the containers in which they are received to the shears or to the torching floor, and then to the cars for shipping or to the bins for temporary storage, is done with 3-ton magnet operating from an overhead crane.

Iron castings returned to the salvage department are placed in bins or inclosures in relatively small quantities and are reduced to marketing or recharging sizes by dropping a steel ball that is raised by a magnet attached to the crane. The broken castings are then either loaded in cars for use in the iron foundry or transferred to storage bins until a sufficient shipping quantity has been accumulated.

Non-ferrous materials are taken care of in this same manner, except that they cannot be handled with a magnet. Moreover, non-ferrous materials have a larger number of different grades and, although their total tonnage is less, it requires closer supervision to keep them separate.

Borings and turnings from both ferrous and non-ferrous materials are kept in separate containers according to their grades, in the machining sections where they originate. They are then sent to the salvage department, re-checked for proper grading, and further divided into two parts according to their degree of cleanliness.

Some of the more uncommon salvaging practices that are a part of the reclamation procedure are:

1. Reclamation of copper from defective and obsolete apparatus by dismantling.

2. Reclamation of the iron oxide that results when metals are either cut or welded with a torch.

3. Excess materials and defective

GOOD LIGHTING

Gets Them to the Fighting Front

FASTER!

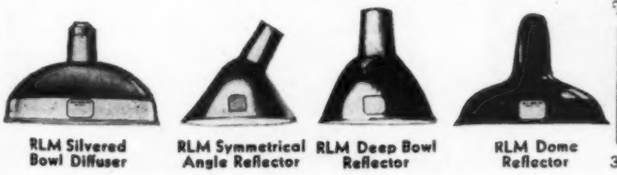
★ The job of supplying our fighting forces with an endless stream of airplanes, ships, tanks, guns and ammunition must not falter. Any plant improvement that will speed production . . . get more output from available skilled workers . . . is both a patriotic duty and a sound investment.

Good lighting is a first essential in maintaining worker efficiency and morale. It helps good eyes do more work more accurately. It enables older workmen to perform tasks that otherwise are beyond the capabilities of their dimming vision.

Adequate lighting—directed for maximum efficiency and energy conservation depends to a large degree upon the basic design and construction of the lighting equipment. Play safe by specifying lighting fixtures bearing the RLM LABEL. This label is your assurance that the fixtures so identified have been tested by Electrical Testing Laboratories; are certified by this independent organization to meet rigid specifications essential to high efficiency, economical operation and maintenance, and ability to withstand vibration and heavy duty service.

Only Industrial Lighting Units built to exacting RLM Specifications are permitted to carry the RLM LABEL. Write for complete set of RLM Specifications, and booklet, "The Meaning of the RLM LABEL".

The Letters RLM Stand for Reflector and Lighting Equipment Manufacturers



RLM Silvered Bowl Diffuser | RLM Symmetrical Angle Reflector | RLM Deep Bowl Reflector | RLM Dome Reflector

RLM STANDARDS INSTITUTE
INCORPORATED

307 N. MICHIGAN AVE. SUITE 1600 · CHICAGO, ILL.

PRODUCTION STEPPED-UP
FUEL SAVED

Comfortable working temperatures are maintained on this Marmon-Herrington military tractor line by Young FH unit heaters, each with a capacity of 800,000 Btu. per hour.

YOUNG HEATING UNITS IN NEW MARMON-HERRINGTON PLANT

To date, more than 5 carloads of YOUNG unit heaters and convectors have been installed in Marmon-Herrington's rapidly growing plant. This company is one of many manufacturers now specifying YOUNG heating units for new plants and to modernize existing facilities.

YOUNG units provide maximum heat output at minimum fuel cost. They have a quick pick-up and circulate an ample supply of warm air to promote health and efficiency among workers. They have patented features of construction that assure easy installation and long, trouble-free operation. Ask the YOUNG representative in your city for engineering data, or write to—

YOUNG RADIATOR CO.
Dept. 122-J, Racine, Wis.

Young
HEATING, COOLING AND AIR CONDITIONING UNITS

YOUNG *VERTIFLOW* UNIT HEATER

YOUNG TYPE "SH" UNIT HEATER

YOUNG TYPE "FH" UNIT HEATER

YOUNG "STREAMAIRE" CONVECTOR

rotors resulting from die casting are repeatedly remelted until the metals —aluminum alloys—are either burned or become unfit for use as a result of contamination. This aluminum alloy dross is then returned to the foundry for remelting, purification, and re-use.

4. Cleaning, sorting, and grading mica require considerable handling, from which fine slivers and dust are left as a residue. Recently a use for this residue has been found, and it is now considered one of the strategic materials.

5. Grinding wheels play an important part in present-day industry; but they, like other production tools, break and wear out. The salvage department has found buyers not only for the broken parts and wheels worn beyond their economical use, but also for the dust or grit from these wheels.

6. Babbitt material is reclaimed from worn or dismantled bearings and re-used in making other bearings.

7. Metal drums in which materials have been received are either returned to the supplier or sold to dealers.

8. After files have become dull they are reclaimed by sandblasting. Another method of removing the dust and filings from the file teeth is to blow fine silica sand against their backs and then dip the files in a solution of two parts kerosene and one part machine oil. After about three of these cleanings, files are returned to the manufacturer for recutting.

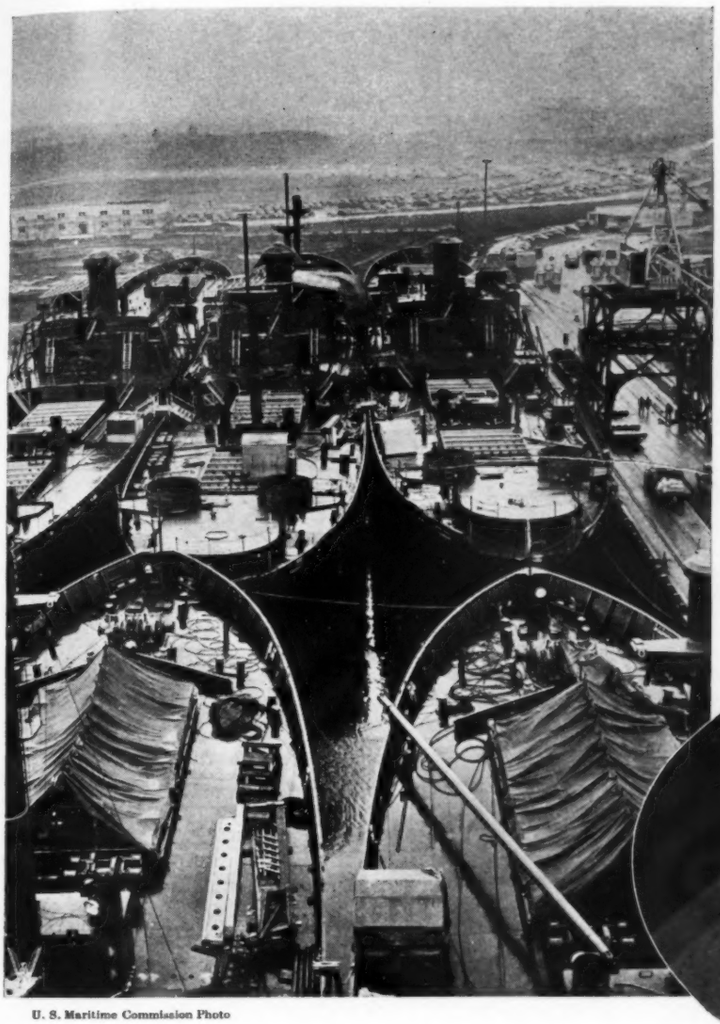
9. A certain amount of broken glass can be used as an oxidizing agent in melting non-ferrous alloys.

Cloth of many forms is used in various products. All trimmings are saved, separated according to condition, baled, and sold to paper manufacturers. Duck is given special consideration as it is more valuable than the "run-of-mine" cloth. Cloth bags also are treated separately, since they can be used for transporting materials both in and out of the plant.

Cardboard, corrugated paper, paper cartons, and the like are carefully saved. The cartons are frequently of value in delivering materials within the plant.

All paper is saved and classified. Booklets, catalogs, and magazines have a higher re-sale value than loose paper sheets. Likewise, spoiled or out-moded blueprints are kept separate and returned to their original source where either cash or credit is given.

Wood in all its forms is salvaged and used in a number of ways throughout the plant—for crates, for patching walls or flooring, as a standing place around machines throwing off borings, turnings, or oil. Even chip boards



U. S. Maritime Commission Photo

Harnessing

SEA HORSES

that are raised and ready for war duty in 46 days!

U. S. Navy Official Photo

● In hundreds of shipyards, America is raising a new kind of sea horse, that can be harnessed to carry 9000-ton loads of vital materiel to our far-flung fighting bases. And the speed with which we're raising these sea horses will amaze you.

In the time it takes a freighter to sail from New York to Cairo and back, the U. S. Maritime Commission can put more than 300 of these new merchant vessels into service. The big reason for this speed is the Liberty Ship—a husky 10,000-ton, 441-foot cargo carrier that is being built by the mass production methods that have made American industry the envy of the world.

Modern spray-painting equipment is a big help in achieving this record building pace. Shipyards are saving days on deliveries with the high-speed painting that is possible with DeVilbiss Spray Equipment. And in hundreds of other plants, busy producing essential implements of war ranging from shell to tanks, DeVilbiss Spray Systems are speeding the delivery of the arms that will sink the Axis quicker.

Maybe you've been wondering how you can get more speed to swell the flow of war materiel to our fighting fronts. Then check your finishing department. If its production rate is determining your delivery schedules, ask DeVilbiss for their suggestions for speed-up.

THE DEVILBISS COMPANY • TOLEDO, OHIO

Canadian Plant: WINDSOR, ONTARIO

• • •

THE COMPLETE DEVILBISS LINE CONSISTS OF: Spray finishing equipment • Automatic coating machines • Tanks for spray materials Spray booths and exhaust fans for vapor and dust elimination Air regulators, cleaners and dusters • Air compressors • Respirators Specialized hose for paint, air, water, gasoline, welding and pneumatic tools • Hose connections • Water and oil guns • Equipment to prevent offset in printing • Paint stripers • Medicinal atomizers.

DEVILBISS
SPRAY SYSTEMS

DEVOE
BAR-RUST PAINTS
Your shield
against structural
deterioration

Rigid priorities are in effect. Replacements are out. Alert management knows it must protect existing metal surfaces against the ravages of rust.

This can be done in only one way—by using a truly rust-inhibitive paint system. Bar-Rust priming coats are scientifically designed to grip those precious metal surfaces and afford maximum protection against rust. Tough Bar-Rust finish coats are specially designed to resist exposure, inside or out. The Bar-Rust System is your guarantee against depreciation.

Let a Devoe Maintenance expert advise with you. Write us, today, for the informative Bar-Rust booklet No. BR-7.

DEVOE & RAYNOLDS CO., INC.

The 188th year of the oldest paint-maker in America

FIRST AVENUE AT 44th STREET, NEW YORK, N. Y.

can be shredded to make excelsior. Sawdust and shavings in proper quantities can be utilized by the paper industry.

It may be well to add that any large piece of any material in sheet or plant form—aluminum, brass, copper, glass, cardboard, cloth, corrugated paper, felt, insulation board, lumber, rockwool, steel—is carefully examined when it is delivered to the salvage department. Many of these items can be used "as is" and are returned to shop for production use.

Significant Labor Developments

(*Continued from page 105*)

WLB Upsets Wage Scale

In conformity with the President's wage stabilization plan, WLB stepped into the copper industry and upset its traditional wage policy. Formerly the wage was determined by a sliding scale based on the price of copper. Now it establishes a basic wage rate for the company which is 70 cents above the present one. Although the increase does not make that rate equal to the rate paid by competitors in the same zone or by other industries in that area, the differential is reduced through the wage increase as a means of diminishing the comparative attractiveness of wages in other war industries and thus discouraging labor turnover. (Phelps Dodge Corporation.)

Grants Increase Despite Loss

The WLB ordered an equalizing wage increase despite the fact that the employer (Transportation Company) was operating at a loss. Recognizing the hardship on the employer, however, the Board rejected all other demands by the union which would increase management's cost, such as vacations and premium overtime pay. (Detroit & Cleveland Navigation Company.)

** Labor Dispute Denied Arbitration*

In a decision indicating the extent to which state courts will go in effectuating the President's labor policy, a New York court ordered that a wage dispute be sent to the War Labor Board despite the fact that an agreement between the parties named the chairman of the New York Board of Mediation as arbitrator of the question. The court held that the state's arbitration law does not make mandatory the court's enforcement of such

Van Dorn Tools

Get 10 hours Production out of an *8 hour day*

"Considerable time saved in drilling, grinding and tapping," reports this heavy-machinery maker, "also a high percentage of increase in production."

Ten hours' work in eight hours! That's a 25% production increase! And Van Dorn Tool users report many even larger increases over former hand tool operations.

In building the machinery and implements of war—in all the operations of drilling and tapping, screw driving and nut-running, grinding and sanding, sawing and sheet-metal cutting—Van Dorn Tools are saving thousands of man-hours every working day and night. Powered *right* for the job . . . they're precision-built to "take it," no matter how tough the assignment.

Ask your Van Dorn Jobber for help on any tooling-up problem. He'll show you what Van Dorn Tools are doing for others and what they can do for you. The Van Dorn Electric Tool Company, 719 Joppa Road, Towson, Md.

"Van Dorn"

(DIV. OF BLACK & DECKER MFG. CO.)

Portable Electric TOOLS

"Tappers stand up well under tough usage," says this user of Van Dorn Electric Tools. "We also get parts service without hold-ups."

50% Production Increase reported by this manufacturer through use of Van Dorn Sanders, Screw Drivers and Drills. That means 12 man-hours for every 8-hour day!

★ ★ ★ ★ ★ ★ ★ ★

WAR-BUSY AMERICA EATS WHERE IT WORKS!

. . . served quicker, better by PIX Feeding Equipment

WHY PLANT FEEDING?

Because lunch periods can be shorter yet leave time for relaxation. Because shifts can be staggered to fit production schedules. Because gate supervision can be reduced where men stay in the plant.

WHAT DO YOU NEED?

That depends. Maybe a central cafeteria. Maybe mobile units that *roll into* each department. Maybe a combination of facilities. A Pick Engineer will *know* when he studies your problems, your personnel, your space. Our engineers know a lot about mass feeding—they've planned equipment to fit many types of plants, to stay within many kinds of budgets.

WHAT WILL YOU GET?

Quality equipment built by craftsmen who respect specifications, who build as you would if you could do it yourself. Pick Equipment looks good, lasts a long time, gives years of trouble-free service. That's why a list of Pick installations reads like a "Who's Who" of American industry. And you'll find that *every* user recommends our planning skill and our on-the-job performance.

Send for our 56-page illustrated booklet No. PC8

ALBERT PICK CO., INC. • 2159 Pershing Road • Chicago

America's Leading Food Service Equipment House

FEEDING EQUIPMENT

★ ★ ★ For War Industries ★ ★ ★

an agreement when public policy would not be served by such procedure. (Machinists vs. Stearns & Company.)

** Offer to Increase Wages Not to Be Withdrawn*

An offer by management to raise wages may not be withdrawn merely because the employer and union cannot agree on the scope of the offer. In one case, the union refused to accept the schedule unless it applied to female as well as male employees. Unsuccessful negotiations resulted in WLB's ruling that employees are entitled to a retroactive wage increase to the rates posted by the employer. (Ryan Aeronautical Company.)

** Little Steel Case Sets Wage Formula*

A 15 percent increase was granted in accordance with a formula tied to cost of living. (Inland, Republic, Bethlehem, Youngstown Sheet & Metal).

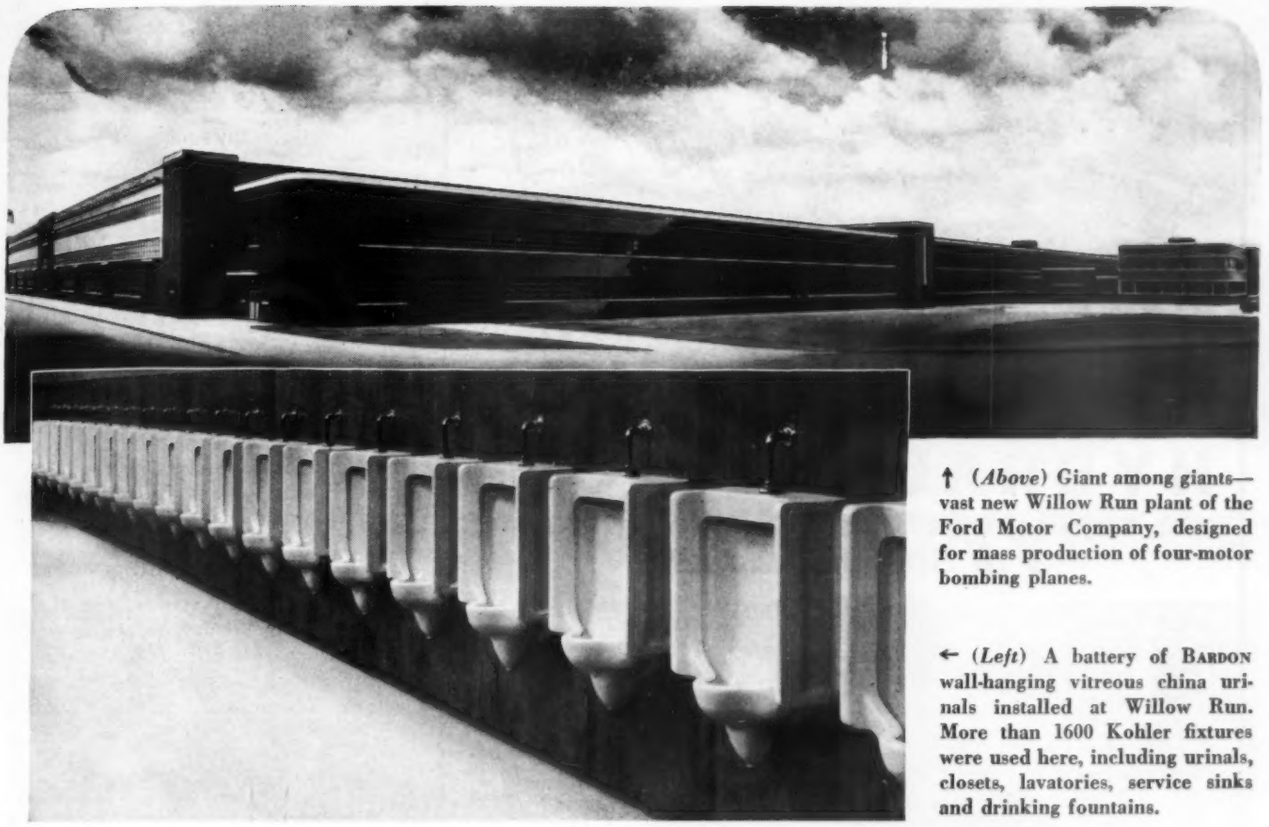
WLB Sticks to Little Steel Formula

Since the Little Steel ruling, WLB has consistently adhered to the standard therein set forth; a total of 15 percent for the period from January 1, 1941, to May 1, 1942. If increases have already been granted partially covering the 15 percent gap, they must be deducted from the total in arriving at increases still allowable. The WLB found that increases already granted have amounted at least to 15 percent in the period; therefore no additional increase was granted. (Remington Rand Company, Inc.)

WLB also refused a general wage increase to employees of General Cable Company on the ground that an increase is unjustified since the wages paid are not "substandard." In the Bayonne plant, the existing minimum is 78 cents an hour for men and 60 cents for women. At the Perth Amboy Plant 72 cents for men, 54 cents for women.

WLB Orders Check-Off

The Board ordered a check-off, voluntary and non-revocable. Instead of the ordinary procedure, under which the union would submit to the employer a list of members and the employer would deduct dues from the pay of those who signified their approval, the new procedure requires the company to furnish in their initial pay envelopes to each employee, nonmembers as well as members, authorization cards returnable to the company. However, those who wish to conceal their membership may thus pay



↑ (*Above*) Giant among giants—vast new Willow Run plant of the Ford Motor Company, designed for mass production of four-motor bombing planes.

← (*Left*) A battery of BARDON wall-hanging vitreous china urinals installed at Willow Run. More than 1600 Kohler fixtures were used here, including urinals, closets, lavatories, service sinks and drinking fountains.

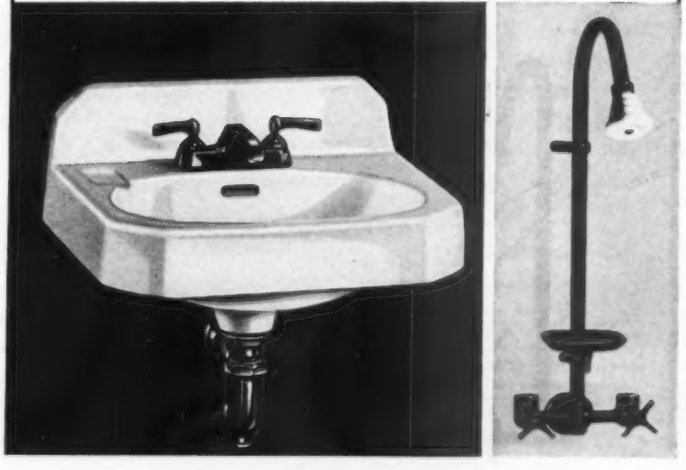
HELPING AMERICA BUILD—FOR VICTORY!

• To supply the vast new workshops of a nation aroused and still save critical materials for Uncle Sam's fighting equipment, Kohler has developed a line of "WIN-THE-WAR" plumbing fixtures and fittings.

Two examples are shown here: the new STACY lavatory and the exposed shower. The 17¼ x 14½-inch STACY is made of vitreous china that is hard, smooth and easily cleaned. Basin is large and deep; fitting is of the mixer type. All ferrous parts of the fittings are smoothly coated, inside and outside, with a baked, black, rust-resistant plastic. Brass is used only for the working parts to retain the efficiency typical of all Kohler products.

You can depend on Kohler products for long, trouble-free service under hard usage. If you plan plant constructions or alterations, write today for our 24-page catalog of fixtures and fittings for industry and public buildings. . . . Address Kohler Co., Dept. FM-9, Kohler, Wisconsin.

Kohler offers "WIN-THE-WAR" fixtures for industrial uses



KOHLER OF KOHLER

PLANNED PLUMBING AND HEATING...ELECTRIC PLANTS

Speed-up your war production work!

HEIN-WERNER
HYDRAULIC JACKS
are super-powerful and easy-operating
3 to 30 tons capacity

As one of the oldest and largest manufacturers of hydraulic jacks, Hein-Werner produces jacks that are built right and priced right. And the purchasers of *over a million* Hein-Werner Jacks know that these jacks are compact, sturdy, safe, fast and easy to operate . . . Great for jobs involving lifting, pressing, bending, etc.

Complete line includes hydraulic jacks of 3, 5, 8, 12, 20 and 30 tons capacity . . . Consult your industrial supply distributor, or write us for details and prices . . . Quick delivery can be made on orders carrying priority rating.

HEIN-WERNER MOTOR PARTS CORP.
Waukesha, Wisconsin

HEIN-WERNER
HYDRAULIC JACKS
Are Built Right and Priced Right

their dues directly to the union. (American Brass Company.)

Deadline for Withdrawal From Union

During the many squabbles over maintenance of union membership the employer members have insisted that the orders provide a definite date after signing of the contract before which employees might withdraw from the union, and thereby avoid the obligation to remain members for the balance of the contract period. WLB made this concession by ruling that the maintenance of membership clause is to be effective for employees who were members of the union at a time 15 days after the issuance of the Board's order. (Ryan Aeronautical Company.)

WLB Bans Change in Agreements

WLB informed management that it may not make new arrangements in allocating work once it has contracted with union members for such allocation. (Nevada Consolidated Copper Corporation.)

** Enforcing Orders Against Labor*

WLB enforced its threat against strikers by calling in the United States Employment Service to fill the places of strikers and directed the company involved to accept qualified employees supplied to it.

In another case Dean Morse denounced labor's refusal to abide by its settlements and stigmatized such conduct as treason.

** WLB Enforces Order Against Union*

The refusal of a union to ratify an agreement reached under the sponsorship of the WLB does not render the agreement of no effect. Despite such a rejection, the Board ordered the agreement put into effect. (Bendix Aviation Corporation.)

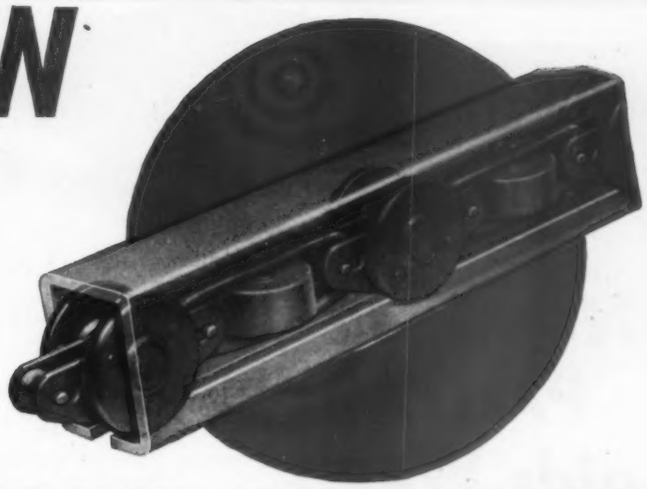
NATIONAL LABOR RELATIONS BOARD

Management May Still Run Its Own Business

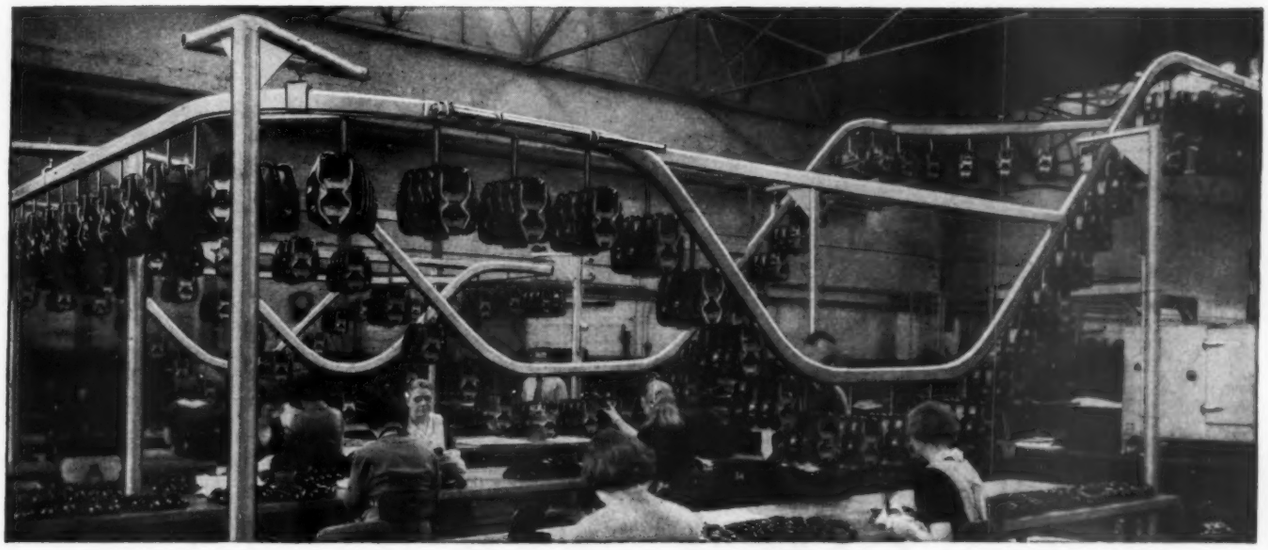
The Circuit Court of Appeals reiterated a rule which the NLRB frequently overlooks, that the Board may not substitute its own ideas of discipline and management for those of the employer. Where, therefore, employees circulated a union petition, in violation of a company rule requiring permission, their conduct was held to constitute insubordination, and was not such a proper exercise of concerted activity as comes within the protection of the Wagner Act. Management still has the right to

BRAND NEW

in principle . . .
efficiency and
flexibility . . .



R-W POWER DRIVE CONVEYOR



Richards-Wilcox, long established as leading producer of overhead track systems, now offers industry the *first* major improvement in design and application of power drive conveyors.

HERE IS WHAT IT IS: The R-W No. 2035 conveyor consists primarily of a steel tube through which runs a continuous chain consisting of vertical and horizontal wheel units on six-inch centers; load capacity 65 lbs. per foot on single suspension, 125 lbs. on double suspension; *two foot radius for horizontal or vertical curves;* special pendants including automatic turning units are available for different installations.

HERE IS WHAT YOU GET: Low first cost • low power factor • fractional horsepower motors used on drive • complete elimination of all sprockets, roller turns, heavy drop rods and excessive bracing • safety resulting from fully enclosed moving parts • *complete flexibility* for efficient installation in any plant • simple installation by any workman • easily changed to meet existing conditions.

The new R-W power drive conveyor has been thoroughly tested by installations in a number of outstanding plants. We invite you to write for Catalog A-78-1 which fully describes this revolutionary unit.

Richards-Wilcox Mfg. Co.

"A HANGER FOR ANY DOOR THAT SLIDES"
AURORA, ILLINOIS, U.S.A.

Branches: New York, Chicago, Boston, Philadelphia, Cleveland, Cincinnati, Washington, D. C., Indianapolis, St. Louis, New Orleans, Des Moines, Minneapolis, Kansas City, Los Angeles, San Francisco, Omaha, Seattle, Detroit, Atlanta, Pittsburgh
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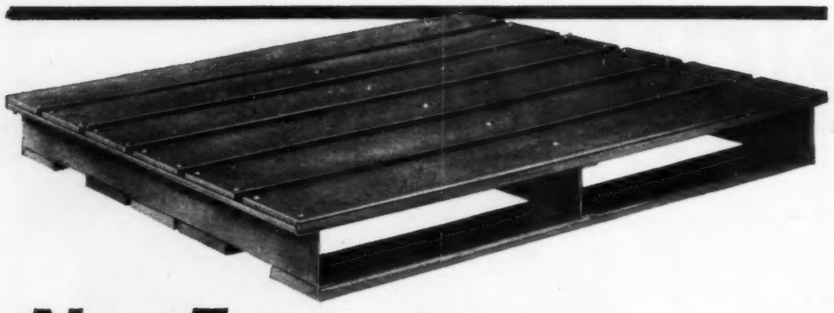
RICHARDS WILCOX R-W AURORA TRADE MARK

1880
62
YEARS
1942



NEW TYPE PALLET aids WAR EFFORT

Here is a new combination wood-steel pallet of bolted construction which permits easy replacement of top and bottom wood slats. Steel-end reinforcements protect the pallet boards from damage by power-fork trucks.

This new unit is designed to aid the war effort by conserving steel and speeding up handling. It is only one of many Union Metal special materials handling units—pallets, skids, and boxes—all designed to save you time and money.

THE UNION METAL MANUFACTURING COMPANY Canton, Ohio

WITT *Cans*
helping to

CAN *the* AXIS

Uncle Sam is calling for more and more cans, which means WITT CANS have gone to war against the Axis. We feel sure our many friends will say O.K. to this, although it necessitates serious curtailment of the supply for civilian needs.

But you can do this to help out in the emergency—take extra good care of each WITT CAN, so it will last even longer than 3 to 5 ordinary cans.

***The* WITT CORNICE Co.**
WINCHELL AVE. CINCINNATI, OHIO

supervise its personnel and insist on proper behavior without running the risk of being penalized by the Labor Board. (NLRB vs. Williamson Dickie Manufacturing Company.)

Management May Sometimes Contract Individually

Where there is no lawful representative of employees with whom the employer must deal, he is free to make whatever arrangements he wishes with individual employees or small groups. He cannot be charged with interference since such conduct is not interpreted as discouragement of concerted activity. (In this case the employer was found to have paid the strikers their regular pay and sought merely to equalize compensation.) (Charles Bloom, Inc.)

What You Can't Say

When advice becomes vocal, pressure was indicated by the NLRB in a ruling that the following statements were unlawful:

1. Unions never did anybody any good.
2. Unionization will create a wall and barrier between employer and employees.
3. A particular union, not favored by the employer, would demand wage scales which would necessitate curtailment of work and personnel. (Imperial Lighting Products Company.)

Individual Contract Must Yield to Collective Bargaining

Even though certain subjects are covered by individual contracts, an employer is required to bargain with a majority union, and even to repudiate such contracts despite the fact that the contracts were voluntarily entered into by the majority of the employees and contain no anti-union features. (J. I. Case Company.)

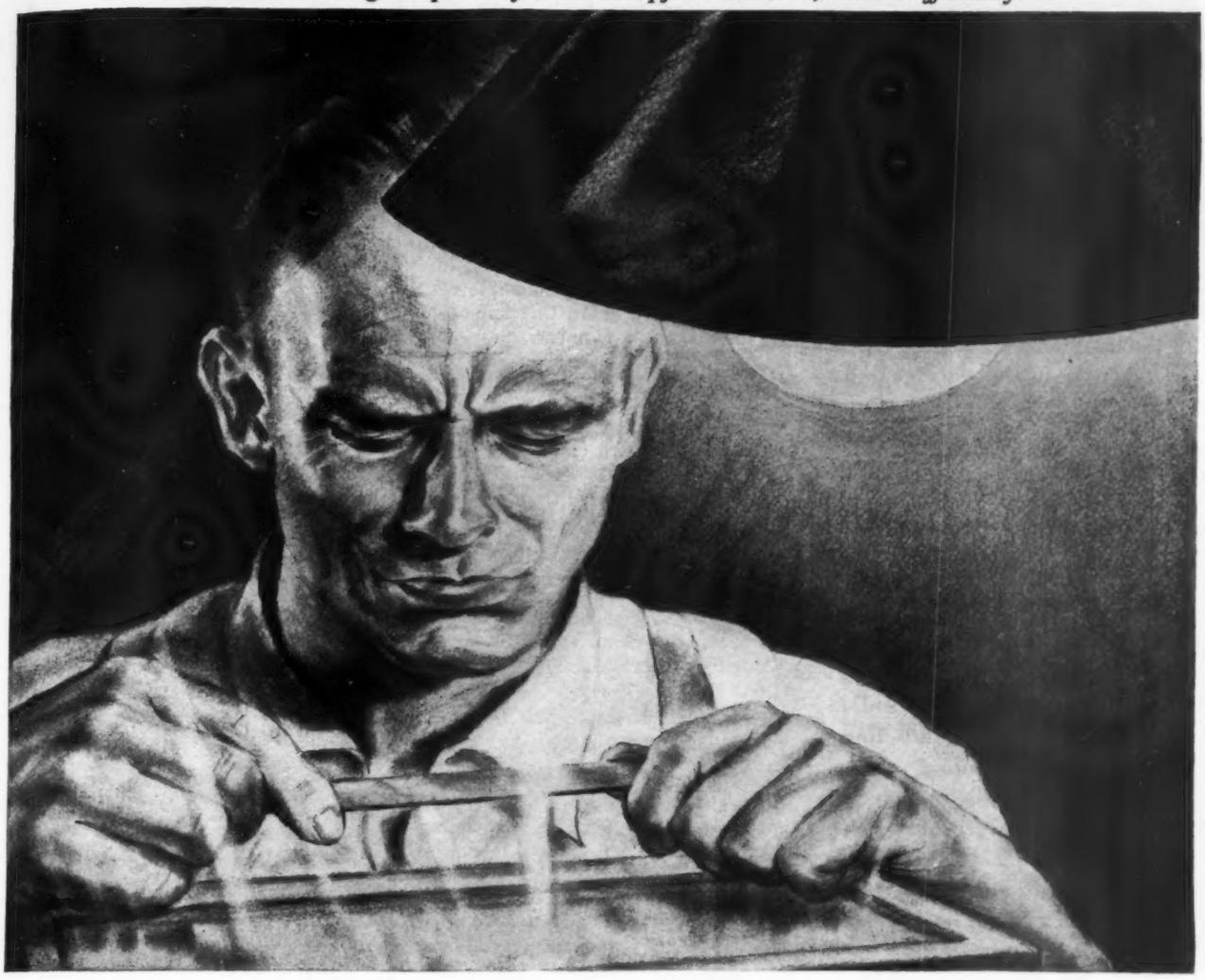
Employer May Not Override Bargaining Agent

An employer may not go over the head of a union bargaining committee. Any such conduct was held to constitute a violation of the Wagner Act even though the union does not repudiate the committee. The employer's lack of cooperation and attempts to avoid negotiations confirmed the Board's finding of a refusal to bargain collectively. (NLRB vs. Martin Bros. Box Company.)

Discharge for Sham Reasons

Discharge of an employee on the alleged ground that he suffered from

A MILLER Message inspired by WPB's helpful handbook, "Plant Efficiency."



How many "SQUINTING SAMS" in your plant?

Can your men see clearly and sharply . . . at all times, on all jobs? Does your plant have adequate lighting for fast, precision war production? Don't "light-starve" your workers . . . give them real working *daylight* from a MILLER *Continuous Wireway* Fluorescent Lighting System.

WPB says better lighting brings these benefits . . . "1— Increased production; 2— Better workmanship; 3— Continued production by older employees; 4— Less eyestrain; 5— Reduction in accidents; 6— Better morale; 7— Better housekeeping."

In war plants from coast to coast the MILLER *Continuous Wireway* Fluorescent Lighting System is now delivering such benefits.

MILLER 50 FOOT CANDLER or 100 FOOT CANDLER will provide your plant with fine, man-made *daylight* . . . adequate, productive illumination evenly distributed over every working surface. MILLER TROFFERS will duplicate that performance in your plant offices and drafting room.

MILLER, by virtue of almost 100 years of lighting experience, working with all types of light sources . . . filament, mercury vapor and fluorescent . . . can give you exactly the lighting equipment you need today, engineered to the "seeing" tasks of your kind of business, and constructed to effect savings in critical materials in line with WPB requirements.

A MILLER field engineer (located near you) is available to assist you in the planning of the proper lighting layout for your plant and in every other way possible. For prompt action, write or wire us today.

BUY U. S. WAR BONDS

MILLER
50 FOOT CANDLER
100 FOOT CANDLER
MILLER TROFFERS
Continuous Wireway Fluorescent Lighting Systems
THE MILLER COMPANY
MERIDEN, CONN.
Pioneers in Good Lighting Since 1844
• MILLER offers a complete line of filament and fluorescent lighting equipment.

SPEED the flow of war production with Bond Truck Casters! *Specialized* experience builds special advantages into these sturdy, smooth rolling casters. For Bond builds *industrial* truck casters *only*...and they're *built-for-the-job*. Write for free Bond Data Book.

BOND FOUNDRY & MACHINE CO., MANHEIM, PA.

BOND 36-A CASTER. Basically different in design, this caster combines easy swiveling with long service. The "reason why" lies in the arrangement of its ball races and its use of durable Bond Caster metal. Pressure lubricated throughout.

Bond
REG. U.S. PAT. OFF.
TRUCK CASTERS

"temper spells" and was guilty of insubordination was held to be discriminatory since the spells were found to have been incited by "baiting" supervisors. (Fairchild Engine & Airplane Corporation.)

Gloating Over Defeat

Revelry and undue rejoicing over the defeat of a union was held to constitute interference. This, coupled with what was styled as unusual liberality in lending money to employees, was sufficient to damn the employer. (Bradley Lumber Company.)

Language

Anti-union language may be regarded as interference with employees' rights in violation of the Wagner Act, where such language is accompanied by anti-union acts indicating hostility to the union. Refusing to bargain in good faith with the union involved and excluding union members from the benefits of wage increases are notable examples of such anti-union conduct. (American Sheet Metal Works.)

** Employee's Right to Select Bargaining Agent*

The California Superior Court upheld the right of employees to select an unaffiliated union as its bargaining agent. The Wagner Act, held the court, prohibits unfair labor practices, discrimination, coercion, interference. It does not ban a "sense of mutual interest" between management and its employees. (American Union Alliance Company vs. AFL.)

Special Workers in Bargaining Unit

Special employees hired to do war production work are entitled to representation in a bargaining unit. The Board refused to classify war work employees in a separate unit from those employees who had been with the firm when it was engaged in peacetime production. (American Rolbal Corporation.)

** Denunciation of Employer Protected By Wagner Act*

The fact that employees passed a resolution condemning their employer for his anti-union activity does not bar them from the protection of the Wagner Act. (Peter Cailler Kohler Swiss Chocolate Company, Inc.)

** Reinstatement Granted*

The Fifth Circuit Court of Appeals approved the procedure of the Board in probing the reason for a discharge

in plants all over the country — are Pioneer Pumps — furnishing proper flow of coolants to the whirling wheels of machinery—to make sure that fighting equipment for Uncle Sam is being produced under most efficient conditions.

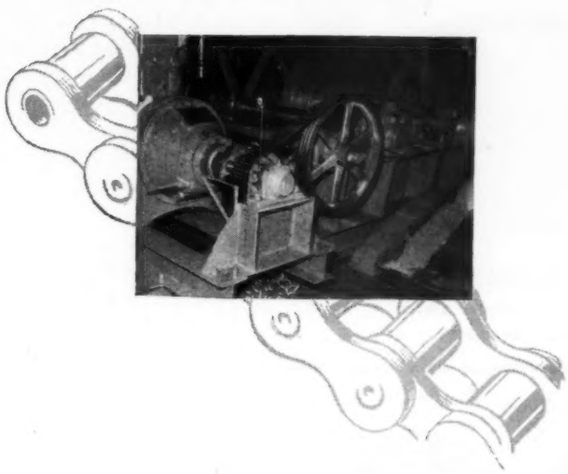
Over 375 different pump models are represented—each one selected for its particular place because its design best fits the job at hand.

Pioneer Pumps are dependable.

PIONEER PUMP AND MANUFACTURING CO.
19644 JOHN R DETROIT, MICH.

HOW to get more from your machines QUICKLY!

You can, and easily, merely by eliminating these three power transmission "bugaboos":



A *Slippage*—a slipping drive never allows peak machine production.

B *Repairs*—machines shut down for drive repairs are dead weights on any production schedule.

C *Power loss*—you deserve as near as possible 100% return on your power investment.

Why use BALDWIN Roller Chain Belts?

PLEASE NOTE

Baldwin roller chain belts transmit power between shafts with nearly 100% efficiency, yet absorb shocks and stand up under conditions of heat, abrasion and corrosion that seriously impair other power transmission media.

★

● Baldwin roller chain belts are 98.6% efficient on long or short centers. They eliminate slippage; they last longer, they run quietly.

By replacing with Baldwin roller chain belts—a few gear drives here, a few belt drives there—on conveyors, machine drives, timing on all production machinery—you'll gain an immediately noticeable improvement in production.

For further explanation of these advantages, call the Baldwin man. Baldwin-Duckworth Division, Chain Belt Company, 327 Plainfield Street, Springfield, Mass.

POSITIVE! THAT'S BALDWIN ROLLER CHAIN BELTS

90 SECONDS OR LESS MAY SAVE A LIFE

...when given to scrubbing and drying floors by the HILD System

Oil and grease get thickest . . . and most dangerous . . . on the floors adjacent to and under machines. Here one false step may lead to serious injury.

Remove these danger spots with HILD System Shower-feed Scrubbing and Vacuum Drying! Workers need be asked to step aside for only 60 to 90 seconds, while a two-man crew working with HILD Equipment gets the floors clean, dry . . . and *slip-safe*. So well does HILD Equipment work in congested areas that continuous three-shift operation need not be interrupted. Get complete information!

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HILD System MAINTENANCE EQUIPMENT & SUPPLIES

HILD FLOOR MACHINE COMPANY

Representatives in 48 States

1313 W. Randolph St., Dept. FM9, Chicago, Ill.

Hammond NO-DUST GRINDERS*

Added 50% Valuable Floor Space to Our Department

*Completely Self-Contained Grinder with Dust Collector in-the-Base

3 POPULAR SIZES

For 10", 12", and 14" Wheels

Hammond NO-DUST Grinder Units require only 6½ sq. ft. of space where average grinder with independent dust collector requires almost 15 sq. ft. The NO-DUST Grinder is the most compact unit of its kind on the market. As a result of this great space saving feature, the Hammond NO-DUST Grinder may be placed closer to walls, nearer post supports, or in line back to back. The dust collector is mounted inside the grinder base. No further need to figure out independent connections to permanent dust collector systems. Set it up anywhere near electrical outlets and put it to work.

FRONT VIEW

REAR VIEW

WRITE FOR BULLETIN GP-13

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by examining the circumstances surrounding it and agreed that the Board need not accept the employer's contention that the employee was discharged for violating a company rule. In granting the reinstatement, the Court pointed out that there was evidence that the rule was honored more in the breach than in the observance. This is further proof that circumstances may "hang" management. (NLRB vs. Kohen-Ligon-Folz, Inc.)

* *Illegal Strike Bars Reinstatement*

The Circuit Court of Appeals ruled that the breach of a no-strike agreement is sufficient justification for denying reinstatement to striking employees despite the fact that the strike was caused by the employer's unfair labor practices. (NLRB vs. United Biscuit Company of America.)

* *Election Cancelled for Union Violence*

For the first time NLRB set aside an election when the winning union won its majority by employing violence. The union was found to have forcibly prevented the distribution of leaflets on behalf of an unaffiliated union rival of an AFL union, and was assisted in its electioneering by the Management. (National Tea Company.)

Where Plastic Replaces Rubber

(*Continued from page 107*)

valves, traps, pumps, and gages on evacuating and sealing machines consisted of molded sections made from almost pure gum rubber.

When the RCA management heard the first whispers of possible rubber scarcities, it set up a rubber conservation campaign, aimed (1) at conserving and prolonging the life of the rubber then on hand, and (2) at seeking out alternative materials wherever possible.

In pursuing this second objective, trials of many flexible plastics and rubber-like materials were inaugurated. These resulted for the most part in early recognition that a majority of these materials offered limited possibilities as a replacement for rubber. Others were discarded when they showed signs of uncertain availability. Still others were dropped because they contained high percentages of natural rubber. Eventually the search narrowed down to a semi-

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*MORE PRODUCTION with **LESS TOOLS

Tool Crib at Philadelphia Gear Works, equipped with McCaskey Control.

*TIME SAVED IN TOOL CRIB SERVICE

Time studies, confirmed over and over again by every day experience, have shown that tool service with McCaskey Control is much faster than with checks and other systems. More production is the direct result of reducing the non-productive time required for drawing and returning tools. There are no delays at the windows of McCaskey equipped cribs.

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**TOOLS NOT IN USE CONSTANTLY AVAILABLE

McCaskey provides a simple means for enforcing the return of tools when a job is completed. Tools are kept in constant circulation. They are immediately available instead of accumulating in operators' tool boxes. No time is wasted locating tools that are out, whether loaned to employees or out for reconditioning. You may check, in a moment, where they are and when they were taken out.

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TRANSACTIONS SPEEDED UP

The tool supervisor of a large brass manufacturer says: "The use of McCaskey Tool Control saves hundreds of hours a week for our set-up men, machine operators and crib attendants and has enabled us to materially reduce our crib inventory."

SMALLER CRIB INVENTORY

From the Comptroller of a large electrical manufacturing company: "We also have a *better balanced* tool inventory with smaller crib stocks of numerous items (thru McCaskey). Our tool investment has been reduced and time is no longer wasted searching for tools on the production floor."

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plastic made of polyvinyl-alcohol material.

Preliminary investigation proved that this material was highly resistant to the many solvents that attacked the rubber used in RCA's various metal cleaning and other manufacturing processes. These involved the usual carbon tetrachloride, trichlorethylene, acetone, and many others. Further tests showed that tubing made from the new plastic would convey hydrogen, oxygen, nitrogen, illuminating gas, and air as effectively as rubber. Such tubing has since stood up for months even though saturated with hot oil and subjected to continuous flexing at a rate of about 600 times an hour.

Another advantage lies in the fact that the compound from which the tubing is extruded can be varied to meet the particular requirements of specific applications. Thus when RCA first started experimenting with the material, the makers formulated a special compound to meet its needs, and fabricated from this a cotton-covered hose especially adapted to its processes. The company has now standardized on this hose for many uses where a quantity of high-grade gum rubber was formerly employed. Already the life of this new tubing has proved to be far in excess of that frequently experienced with natural and synthetic rubber. For example, a hose assembly placed on a machine nearly a year ago has still to show any sign of deterioration, whereas rubber hose had to be replaced as often as five times a year.

Plastic for Metal

In addition to replacing rubber with the new tubing, RCA is also using it to displace flexible hose made of brass, copper, or stainless steel. In certain instances even conventional copper tubing and fitted piping are also being so displaced.

Although the replacement of rubber tubing was a major objective of the RCA conservation campaign, it did not stop there. The company was also using rubber for many machine parts of a highly mechanical nature. Experiments with the plastic tubing had revealed that, in addition to having high solvent resistance, and exceptionally low permeability, this material was extremely tough and stood up under both flexing and abrasion. The makers were therefore asked to revamp samples of sheet stock until a compound was arrived at which conformed to the Durometer index and texture of the rubber normally used.

Testing the alternate material was simplified by the ease with which blocks could be fabricated. Pieces were cut or punched from sheet, then

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As in our own United States, workers in Canadian war plants need protection for themselves and their machines from the many DUST HAZARDS that always come with stepped-up industrial production.

The picture above, taken at one of the largest munition plants in the Dominion shows a typical small Pangborn installation doing a BIG JOB removing dust from a blast cleaning department in a steel foundry.

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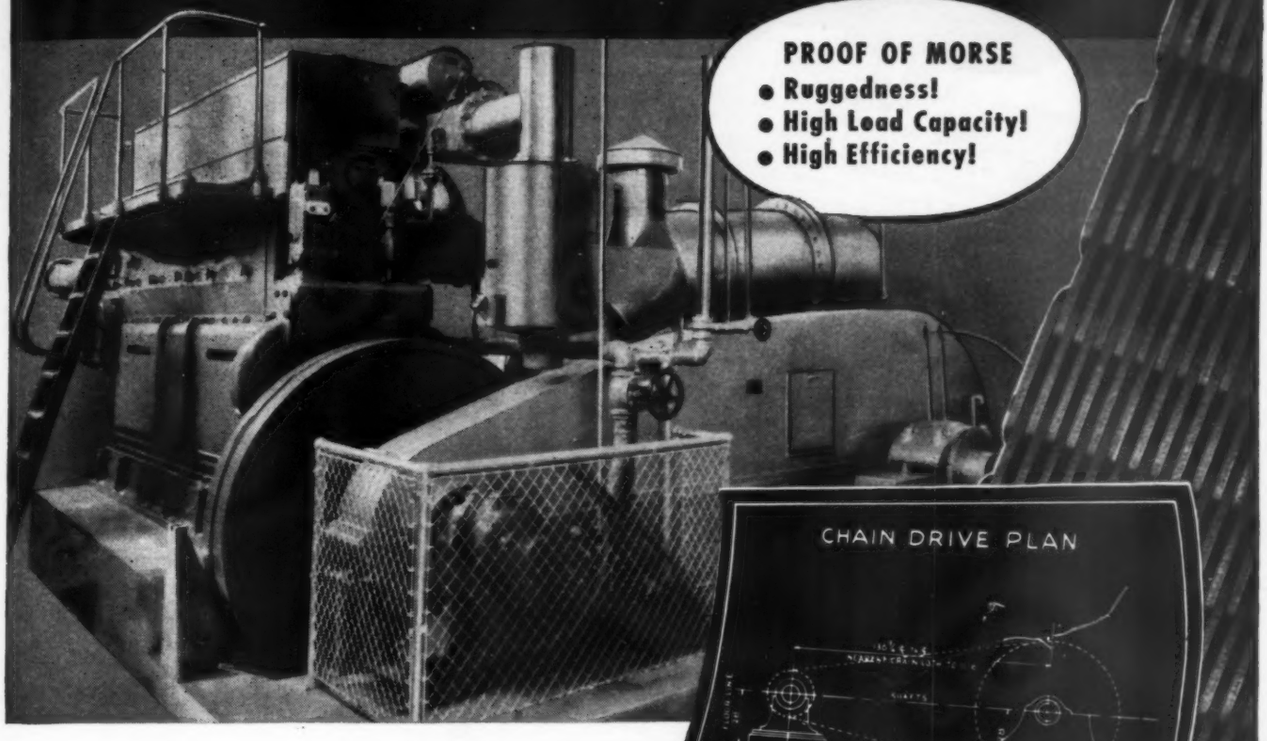

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laminated into washers, spacers, rollers, etc., without the need for any special presses or molding machinery. Rough shapes so formed were machined to required dimensions on standard shop equipment. Some sections were frozen solid in liquid air or mounted on wooden blocks to facilitate machining.

In these mechanical applications, involving abrasive action and torsional strains, the substitute has consistently outlasted rubber. A typical instance involves a power transmission device, wherein a revolving turret carries a series of heads, which in turn are revolved in a sequence of indexed positions. The heads are caused to rotate when their shallow-toothed, metal drive gears are brought into mesh with rings clamped to driven shafts below the turret. The plastic material has replaced rubber for these power transmission rings, and is consistently outwearing the former product.

Lasts Several Weeks

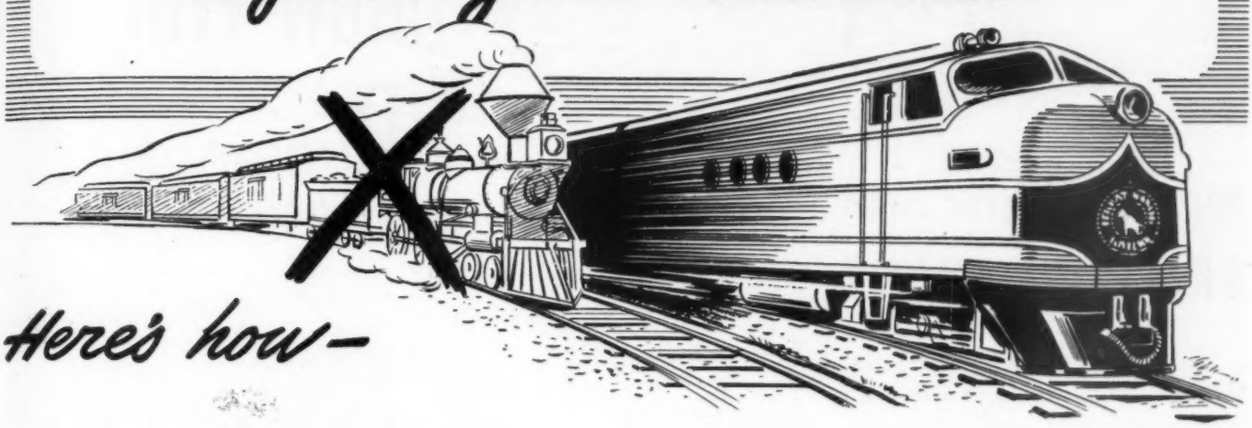
In another case a two-ply tube was formed by rolling sheet plastic about a mandrel, and installed in a sandblast suction line where rubber tube had worn through in a few days. The replacement tubing has been running for several weeks, and has proved so satisfactory that the company is now ordering special molded tubing for this application.

In the same machine, sandblast shields made of sheet have likewise proved more durable than rubber, while it has also been possible to fabricate the compound to combine maximum protection with the flexibility needed for easy operation.

The list of operations where the "substitute" material is becoming the standard is growing daily. Among the mechanical parts now being fabricated from the synthetic resin are forming rollers, forming-press jaw linings, aligning devices, shock absorbers, power transmission rings, pedal coverings, and metal belt pulley facings. It is called for in ball mill cover gaskets where it stands up under solvents which destroyed previous gaskets made from natural or synthetic rubber. Sections of sheet material have been cemented together to make a small parts conveyor belt which has proved superior to a belt made of woven wire.

Actually, RCA's rubber conservation campaign has resulted not only in releasing quantities of the scarce material for more direct use by the armed forces, but also in technological advances through the necessity of testing a material that normally might not have been considered.

BAKER TRUCKS can help you to Speed your deliveries



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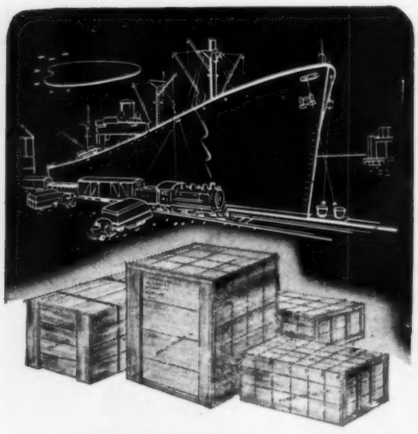

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Management Shorts

(*Continued from page* 110)

scale, and placed a 16-ft. length of roller conveyor on each side of the platform. The boxes are weighed empty, and are then placed on one of the side conveyors, which is at a convenient height for packing. After packing, one man pushes the box up to the scale platform for weighing while the other man prepares another case for packing. After weighing, the box is pushed to the conveyor on the opposite side, where the packing list is put inside the box and the cover is nailed on. The shipping address and other details are also marked on the box while it is still on the conveyor. The last ride to the end of the conveyor brings the box to a convenient place to be shipped out.

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SOURCE—Wright Aeronautical Corporation, New York

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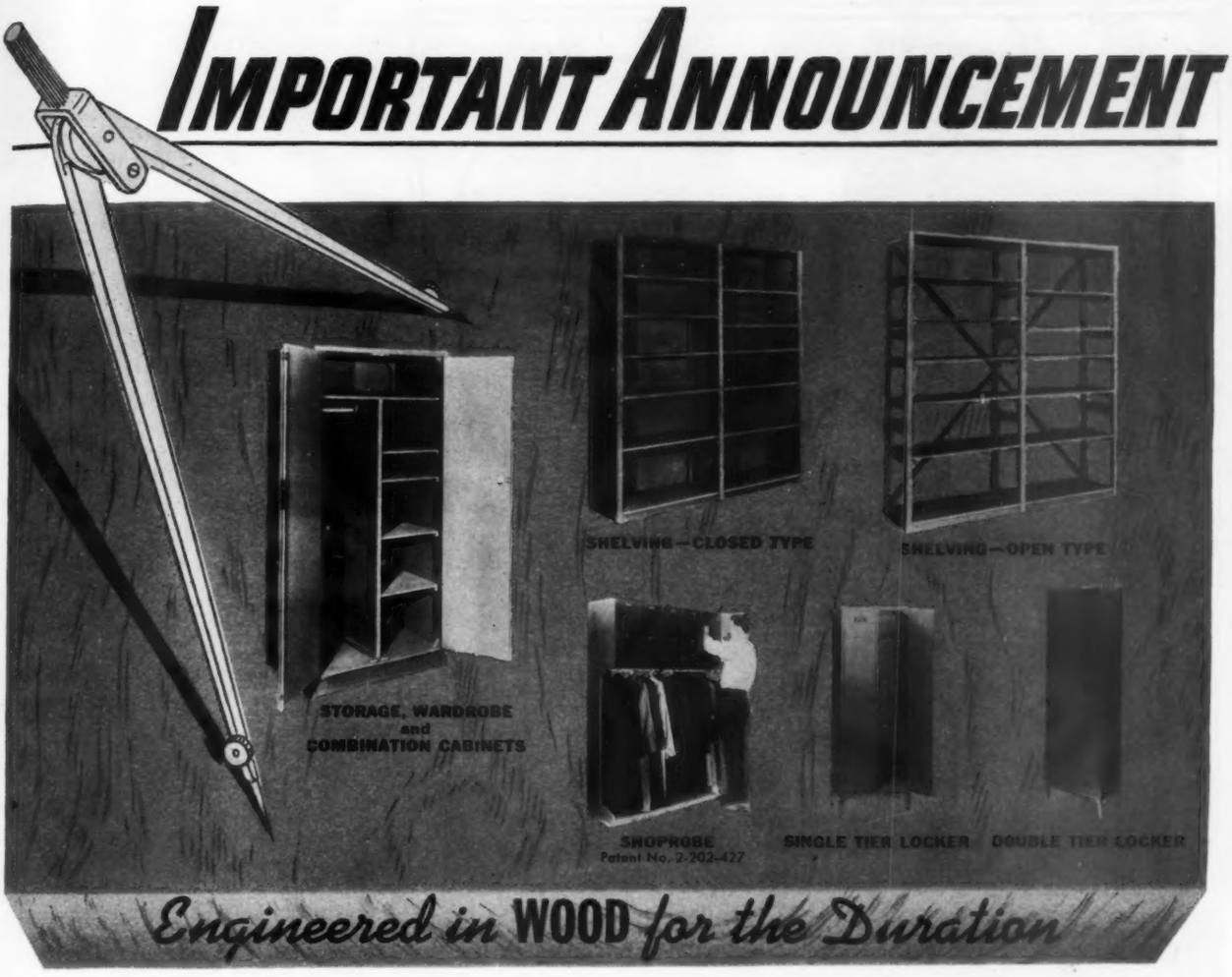

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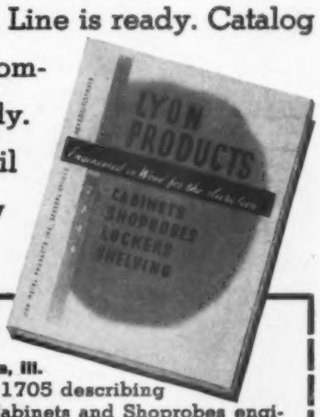

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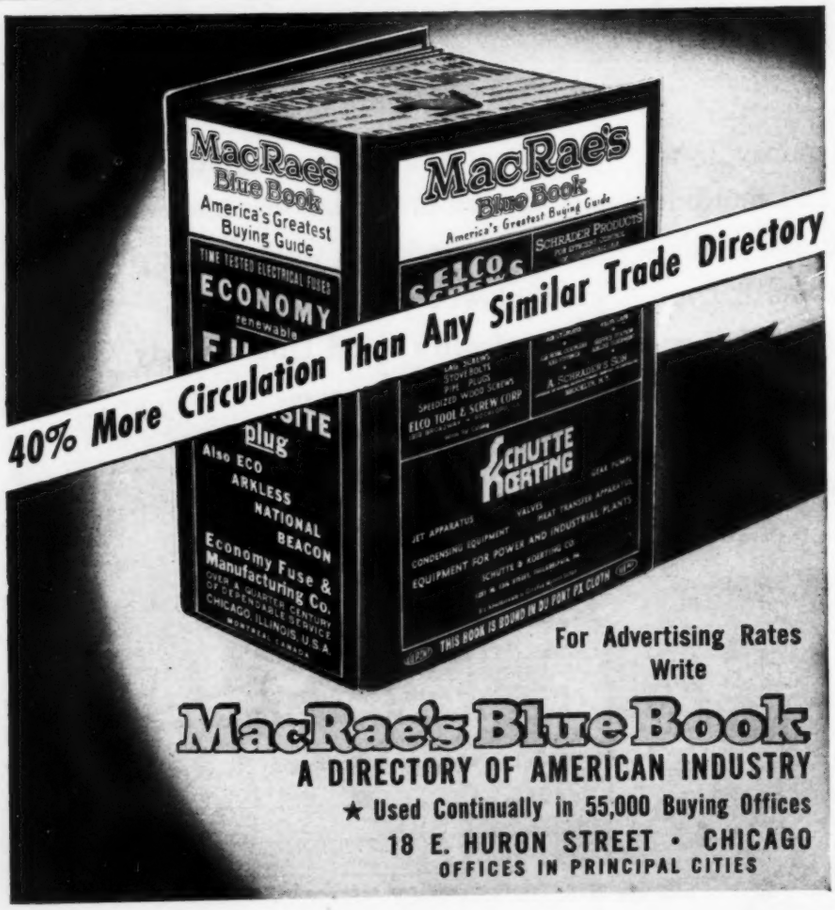

in the color combination appearing on the machine. Thus, when a machine tool operator dumps steel shavings from the collection bin attached to the machine into the portable salvage receptacle, he must be sure that the "V" on the machine and the "V" on the receptacle match.

•

Safety First Greets Employees First Thing

R. A. SHAW, Safety Director, The Murray Corporation of America, Detroit

To keep "safety first" first in employees' minds, the Aircraft Division of the Murray Corporation installed a board flasher opposite the timeclock at the two general entrances. Situated thus, it is directly before all employees as they turn from the timeclock after punching in. A flasher at the top reads "Safety First." Beneath it is space for safety warnings or slogans, or any special message to employees—"Plant Holiday Monday," "Baseball Saturday." We consider it advisable to change the sign every day.

•

Stitching Machine Lowers Packaging Cost

SOURCE—Acme Steel Company, Chicago

Formerly, when fastening cartons together for shipment, KB Products Corporation, Coxsackie, N. Y., growers and canners of mushrooms, used glue for the job. Then they installed a stitching machine and were able to make a saving of 30 percent in material and labor. One hundred car-